MEETING THE CHALLENGES

STATE OF THE LANDSCAPE REPORT

Alberta
Environment

Southern Alberta Landscapes

MEETING THE CHALLENGES AHEAD ▶▶

STATE OF THE LANDSCAPE REPORT

Alberta
Environment

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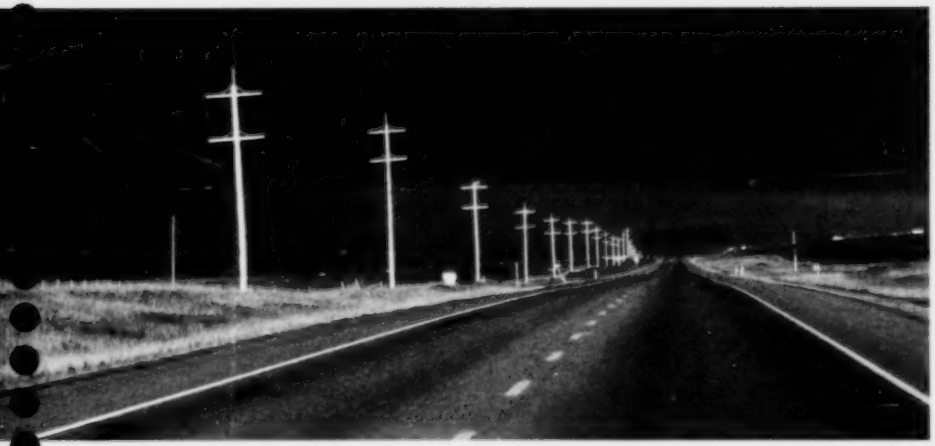

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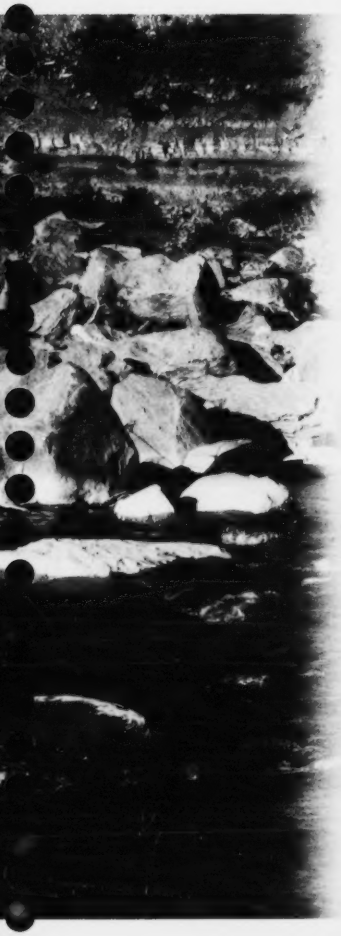
Executive Summary: State of the Landscape



Southern Alberta Landscapes: Meeting the Challenges Ahead (SAL) Report represents a "snap shot" of southern Alberta as it is today. The report looks at some of the historic trends that have resulted in the current landscape but is intended primarily as a tool that provides the contextual framework for discussion of current issues and future trends in the SAL region.

The SAL region includes all of the Alberta portion of the Grasslands Natural Region, the South Saskatchewan River Basin, and the Alberta portion of the Cypress Hills. Major urban areas include Red Deer, Airdrie, Calgary, Lethbridge, and Medicine Hat. In total, the SAL region includes about 17% of the total area of Alberta, or 112,500 km^2, with a population of about 1.5 million, or about half the population of the province.

Historic landscape change has been significant in southern Alberta, largely driven by agricultural expansion with the settlement of the province. Two-thirds of the region's native grasslands have been converted to other land covers, from pre-settlement times to today, and 10% of the forested land cover has been transformed. Today, 48% of the SAL region is in native land cover and 52% is anthropogenic edge, including cities, roads, wellsites, cropland and rural residential development.

ECOSYSTEMS AND NATURAL REGIONS

The SAL region includes five of the six natural regions represented in Alberta, and 12 of the 20 sub-regions. The largest natural region is the Grassland, with Parkland, Foothills, Rocky Mountain and Boreal Forest constituting the rest of the landscape.

WATERSHEDS

There are two major river basins in the SAL region - the South Saskatchewan and the Milk. In the extreme northeast corner, a portion of the Battle, a sub-basin of the North Saskatchewan River Basin, loops into the region. The South Saskatchewan River Basin, which includes the Bow, Oldman and Red Deer Rivers and their tributaries, drains 120,000 km^2 of the province. The Alberta portion of the Milk River Basin, in the far south, is 6,500 km^2 .

AIRSHEDS

In Alberta, air quality is monitored and managed by the Clean Air Strategic Alliance (CASA). To date there are two airshed zones in the SAL region – the Parkland Airshed Management Zone and the Palliser Airshed Society – with a new zone being formed in the Calgary - Bow Valley region, called the Calgary Regional Airshed Zone.

BIODIVERSITY AND SPECIES AT RISK

There is a wide diversity of plants and animals in the region. More than 75% of Alberta's species at risk are in the southeast region of the province. Wildlife-human conflicts are increasing with population growth and land fragmentation.

SETTLEMENT

The SAL region includes 19 counties, nine municipal districts, three Special Areas, three improvement districts, and six First Nation Reserves. There are 12 census divisions.

Most of the urban population lives in the region's six cities: Calgary, Red Deer, Airdrie, Lethbridge, Medicine Hat and Brooks. Calgary, with a population of 1,021,060, is the fourth largest city in Canada, with average annual increases from 1997 to 2001 of approximately 17,000 persons a year. Significant new growth (country residential) is taking place to the west of the Calgary, on the Eastern Slopes of the Rocky Mountains.

Executive Summary: State of the Landscape

TRANSPORTATION

The SAL region currently has more than 13,140 kilometres of major roads and about 109,600 kilometres of minor roads and trails. There are about 4,380 kilometres of railway track. Roads and rail lines are not evenly distributed in Alberta, being concentrated more in the southern half of the province.

The majority of roadways are in the form of smaller local or municipal roads that provide basic land access and link together to form a network serving the local population.

AGRICULTURE AND IRRIGATION

In 2001, the Agricultural Profile of the SAL region included:

- Approximately 25,000 farms,
- 66,560 km^2 of cropland, and
- 6,000 km^2 of irrigated land.

Irrigation greatly increases yields compared to those expected without the benefit of reliable moisture. Irrigation also enables the growing of crops that could not survive on the amount of precipitation available on dryland farms in Alberta.

Major crop types in the SAL region include:

- Cereal crops such as spring- and fall-seeded wheat, malt and feed barley, oats, rye, durum, and triticale;
- Oilseed crops (primarily canola and flax);
- Specialty crops, including field peas, mustard, lentils, dry beans, faba beans, safflowers, sunflowers, canaryseed, herbs and spices, sugar beets, potatoes, corn, and other vegetables grown for commercial production; and
- Forage crops, including alfalfa, brome grass, timothy, wheatgrass, clover, and wild ryes.

The main livestock types are cattle (beef and dairy), hogs, poultry (eggs and meat), sheep (wool and meat), and horses. Currently, there are approximately:

- 4.5 million head of cattle in the region, which represents approximately 68% of the cattle in the province;
- 5.5 million chickens; and
- 1.5 million swine.

Southern Alberta is home to more than 130 agri-food processing companies. While establishments in the food processing industry are diverse, the meat-packing and processing sector accounts for about 50% of Alberta's food processing sales. Other large sectors include dairy, feed, cereal, grain and flour, sugar, canola processing, and frozen fruits and vegetables, particularly potatoes.

ENERGY, MINING AND INDUSTRY

Energy activity in the SAL region includes 51,000 producing oil and gas wells, 184 sweet gas plants, 124 sour gas plants, 116,860 km of pipelines, one active coal mine, and one coal-fired power plant. There is also one gas-fired electrical generation utility and 10 gas fired non-utilities.

There are significant coal deposits at the Sheerness mine near Hanna. Coal production in 2003 was 3.8 million tons, slightly more than 10% of total coal production in Alberta.

Executive Summary: State of the Landscape

As of February 2007, wind farms in southern Alberta had a wind generation capacity of 384 megawatts (MW) (provincial electricity generating capacity is 11,500 MW). There are currently 21 wind projects. As well, there are 18 hydro-electric projects.

Twelve major facilities produce a variety of petrochemical and chemical products, including ammonia, methanol, ethylene glycol, alpha olefins, nitrogen/oxygen, and ammonium nitrate.

A variety of non-energy resource-based industries exist in the region, including a cement plant, lime plants, a brick plant, an ammolite factory, a gypsum, zeolite and barite facility, and an ethane processing plant.

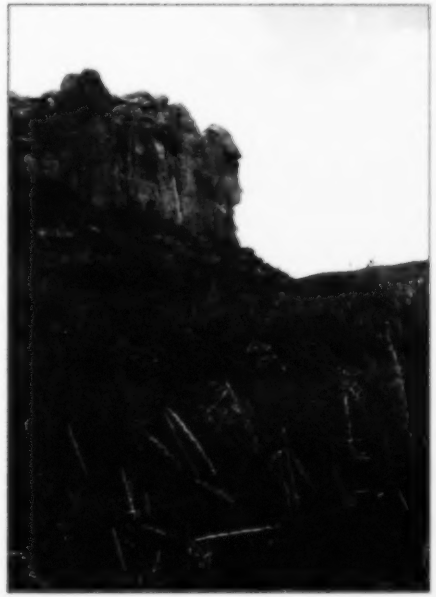
FORESTRY

A relatively small proportion (18,000 km^2 - 16%) of the SAL region is forested. Currently, 48% of the total forested land base is actively managed for timber production. The remainder is in parks, Prime Protection Zone 1, or is withdrawn from the active land base because of proximity to water bodies, steep slopes or other hazards.

There are two Forest Management Agreements within the SAL project boundary, as well as two Community Timber Programs and four Coniferous Timber Quotas.

TOURISM AND RECREATION

Parks and protected areas account for 8,100 km^2 or 7.2% of the land base of the SAL area, compared with 12.4% for Alberta as a whole. There are 12 major ski areas, covering approximately 4,012 hectares, 91 golf courses, with a combined area of approximately 4,400 hectares, and 182 campgrounds, covering an area of 4,830 hectares.



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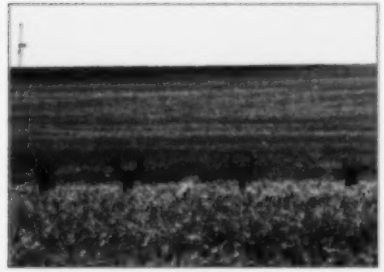


Introduction

STATE OF THE LANDSCAPE

The Province of Alberta is richly endowed with natural resources that have sustained and benefited its citizens economically and environmentally. Recognizing the increasing demand for those resources due to population and lifestyle pressures, the Alberta Government has stated its commitment to the wise management of Alberta's natural resources and environment. The Commitment to Sustainable Resource and Environmental Management was signed for the benefit of all Alberta's present and future generations in March 1999.

Southern Alberta Landscapes: Meeting the Challenges Ahead (SAL) was launched in 2002 as a cross-Ministry, inter-governmental, strategic planning initiative to examine sustainable development issues in southern Alberta. The focus is on understanding the complexity of the landscape, and the effects of human activities on environmental quality. The project is looking at the cumulative effects of changes in land use, resource demands, population increases and climate change over the next 50 years, or two generations, and how those changes affect the sustainability of the environment.

To achieve the goal of a continuing high quality of life in a sustainable environment, SAL is looking at social, economic and environmental data for southern Alberta. The data will assist those working on SAL to:

- Take stock of the current state of the region's resources,
- Assess the consequences of potential changes over the next two generations,
- Identify issues that need to be addressed to ensure a sustainable future, and
- Address the question of how we can meet our social and economic needs while ensuring environmental quality.

SAL is an opportunity to develop a strategic vision of the future of southern Alberta that provides for all the benefits society wants, while ensuring a sustainable environment.

THE SAL REGION

The SAL study area includes all of the Grasslands Natural Region, the South Saskatchewan River Basin, and the Alberta portion of the Cypress Hills. Major urban areas located in the region include Red Deer, Airdrie, Calgary, Lethbridge, and Medicine Hat. In total, the SAL region includes about 17% of the total area of Alberta, or 112,514 km^2 (based on the Natural Resources Canada 2001 figure for the total area of Alberta of 661,848 km^2), and a population of about 1.5 million, or about half the provincial population of 3,413,500 (as of Oct. 1, 2006, Census Canada).

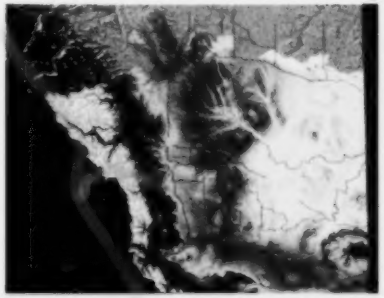


Figure 1. The SAL Region

PURPOSE OF THE REPORT

The State of the Landscape Report represents a "snap shot" of the region as it is in 2006. The report looks at some of the historic trends that have result-

Introduction

ed in the current landscape and, where relevant, raises some of the issues of concern about the landscape. It is intended as a tool that provides the contextual framework for discussion of current issues and future trends in the SAL region. Generally, discussion of those trends will appear in other SAL documents and reference to these discussions in this report will be made only when they are relevant to describing the current landscape.

WHAT'S IN THIS REPORT?

Historic landscape change has been significant and permanent in the SAL region, driven largely by the settlement of the province, agricultural expansion and other human activities. Two-thirds of the region's native grasslands have been lost from pre-settlement times to today, while 10% of the forested land cover is gone. As of 2006, about 48% of the SAL region is in native land cover and 52% is in anthropogenic footprint (48% in croplands and 4% in settlements, roads and other human developments). In addition to the direct influence and effects of human activities, changes in the environment have been caused by edge effects, the alterations to temperature, light intensity, plant and animal migration patterns, and other aspects of the ecosystem caused by the juxtaposition of anthropogenic areas and natural areas. Most of the anthropogenic edge discussed in this State of the Landscape report has occurred since settlement by non-Native people on the Prairies.

Other than croplands, the anthropogenic footprint is comprised primarily of towns & cities (40%), followed by roads (30%). Wellsites occupy 17% of the developed SAL region, followed by rural residential developments (7%). Cereal crops and tame grasses dominate the agricultural land cover and a significant proportion of crops are irrigated. Thus, most of the SAL area has been affected in one way or another by human activities.

This report discusses both the remaining natural landscape and the anthropogenic landscape. Though the population density of the SAL region is relatively low – approximately 13 people per km^2, with most of those people concentrated in the five urban centres – the human effects on the landscape are evident everywhere, through forest practices, tourism, agriculture, the energy industry, and so on. It is these impacts on the landscape that speak to the need for a sustainable development strategy for the SAL region.

Ecosystems and Natural Regions

The SAL region is currently about equally divided between natural landscapes and cropland, with an additional 4% in other anthropogenic footprint. The region's land cover is predominantly grassland and cropland, with smaller areas of forest, riparian areas, wetlands, and built-up areas.

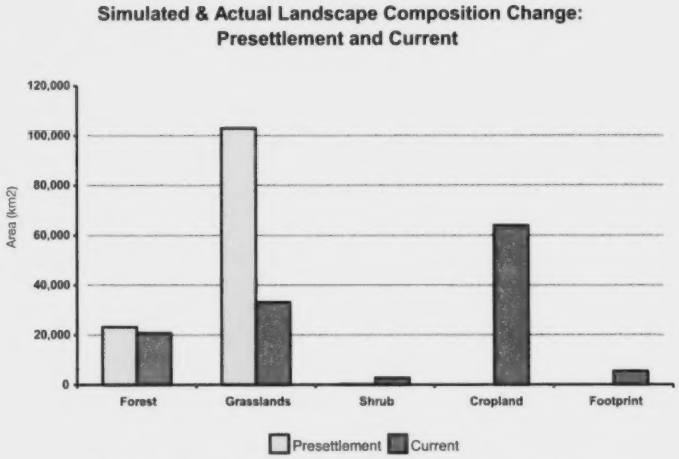


Figure 2. Simulated and Actual Landscape Composition Change

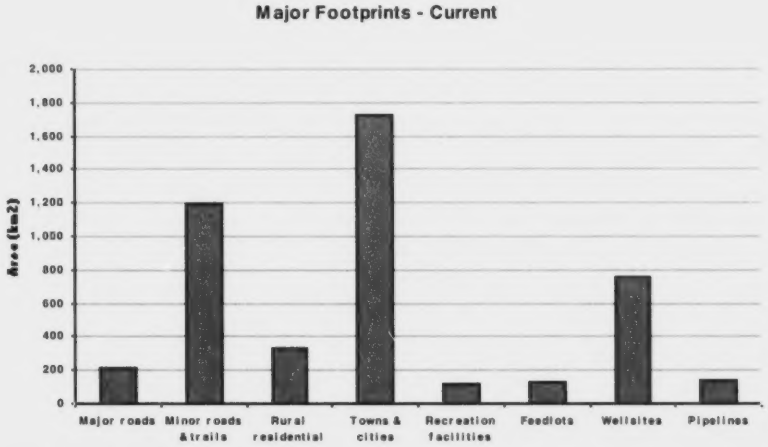


Figure 3. Major Footprints - Current

Figure 2 illustrates how the SAL region has been transformed from the original landscape, dominated by grassland, to a landscape now dominated by cropland. Figure 3, the "Major Footprints" graph, shows the developed parts of the SAL region, including major roads, minor roads and trails, rural residential settlements, towns and cities, recreation facilities, confined feeding operations, wellsites, and pipelines.

GRASSLAND NATURAL REGION

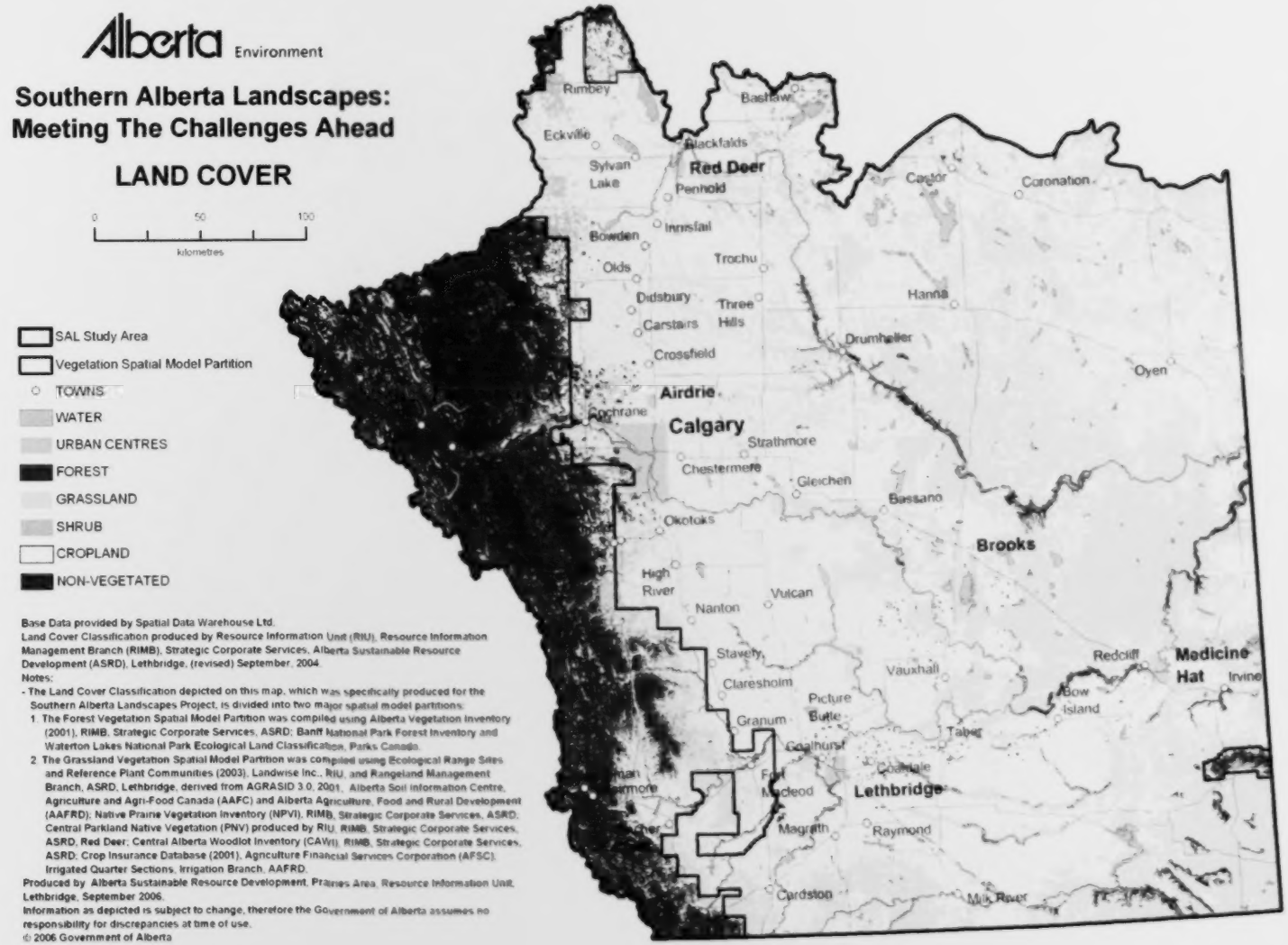
The Grassland Natural Region, which extends west to the Foothills and north to the Parkland of central Alberta, covers 14.5% (96,221 km^2) of the province, almost all of which is in the SAL area. This region is a flat-to-gently rolling plain, with a few major hill systems. Badlands have developed where river valleys and their associated coulees and ravines are carved deeply into bedrock, especially along the Red Deer, Oldman-South Saskatchewan and Milk Rivers.

Grasslands are dominated by grasses, which include rough fescue, bluebunch fescue, Parry oat grass (rare), and bearded wheat grass (common). Extensive narrow-leaf cottonwood forests, found nowhere else in Canada, occur along the Oldman, Belly, Waterton and St. Mary Rivers. Upland wildlife is most diverse on the broad plateaus of the Cypress Hills and the Milk River Ridge.

There are four Grassland Subregions within the SAL region: Mixedgrass, Northern Fescue, Foothills and Parkland. Each is distinguished by differences in climate, soils, and vegetation, as described below.

Figure 4. Land Cover in the SAL Region

Ecosystems and Natural Regions


Alberta Environment
Southern Alberta Landscapes:
Meeting The Challenges Ahead
LAND COVER
0
50
100
kilometres
SAL Study Area
Vegetation Spatial Model Partition
TOWNS
WATER
URBAN CENTRES
FOREST
GRASSLAND
SHRUB
CROPLAND
NON-VEGETATED
Base Data provided by Spatial Data Warehouse Ltd.
Land Cover Classification produced by Resource Information Unit (RIU), Resource Information Management Branch (RIMB), Strategic Corporate Services, Alberta Sustainable Resource Development (ASRD), Lethbridge, (revised) September, 2004.
Notes:
- The Land Cover Classification depicted on this map, which was specifically produced for the Southern Alberta Landscapes Project, is divided into two major spatial model partitions:
1. The Forest Vegetation Spatial Model Partition was compiled using Alberta Vegetation Inventory (2001), RIMB, Strategic Corporate Services, ASRD; Banff National Park Forest Inventory and Waterton Lakes National Park Ecological Land Classification, Parks Canada.
2. The Grassland Vegetation Spatial Model Partition was compiled using Ecological Range Sites and Reference Plant Communities (2003), Landwise Inc., RIU, and Rangeland Management Branch, ASRD, Lethbridge, derived from AGRASID 3.0, 2001, Alberta Soil Information Centre, Agriculture and Agri-Food Canada (AAFC) and Alberta Agriculture, Food and Rural Development (AAFRD); Native Prairie Vegetation Inventory (NPVI), RIMB, Strategic Corporate Services, ASRD; Central Parkland Native Vegetation (PNV) produced by RIU, RIMB, Strategic Corporate Services, ASRD, Red Deer; Central Alberta Woodlot Inventory (CAWI), RIMB, Strategic Corporate Services, ASRD; Crop Insurance Database (2001), Agriculture Financial Services Corporation (AFSC); Irrigated Quarter Sections, Irrigation Branch, AAFRD.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge, September 2006.
Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.
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Rimbey
Bashaw
Eckville
Blackfalds
Sylvan Lake
Red Deer
Penhold
Castor
Coronation
Innisfail
Bowden
Olds
Trochu
Didsbury
Three Hills
Carstairs
Hanna
Drumheller
Crossfield
Oyen
Airdrie
Cochrane
Calgary
Strathmore
Chestermere
Gleichen
Bassano
Okotoks
Brooks
High River
Vulcan
Nanton
Stavely
Redcliff
Medicine Hat
Irvine
Vauxhall
Claresholm
Bow Island
Picture Butte
Granum
Taber
Coaldale
Fort Macleod
Lethbridge
Magrath
Raymond
Cardston
Milk River

Figure 4. Land Cover in the SAL Region

Figure 5. Natural Subregions of the SAL Region

Ecosystems and Natural Regions

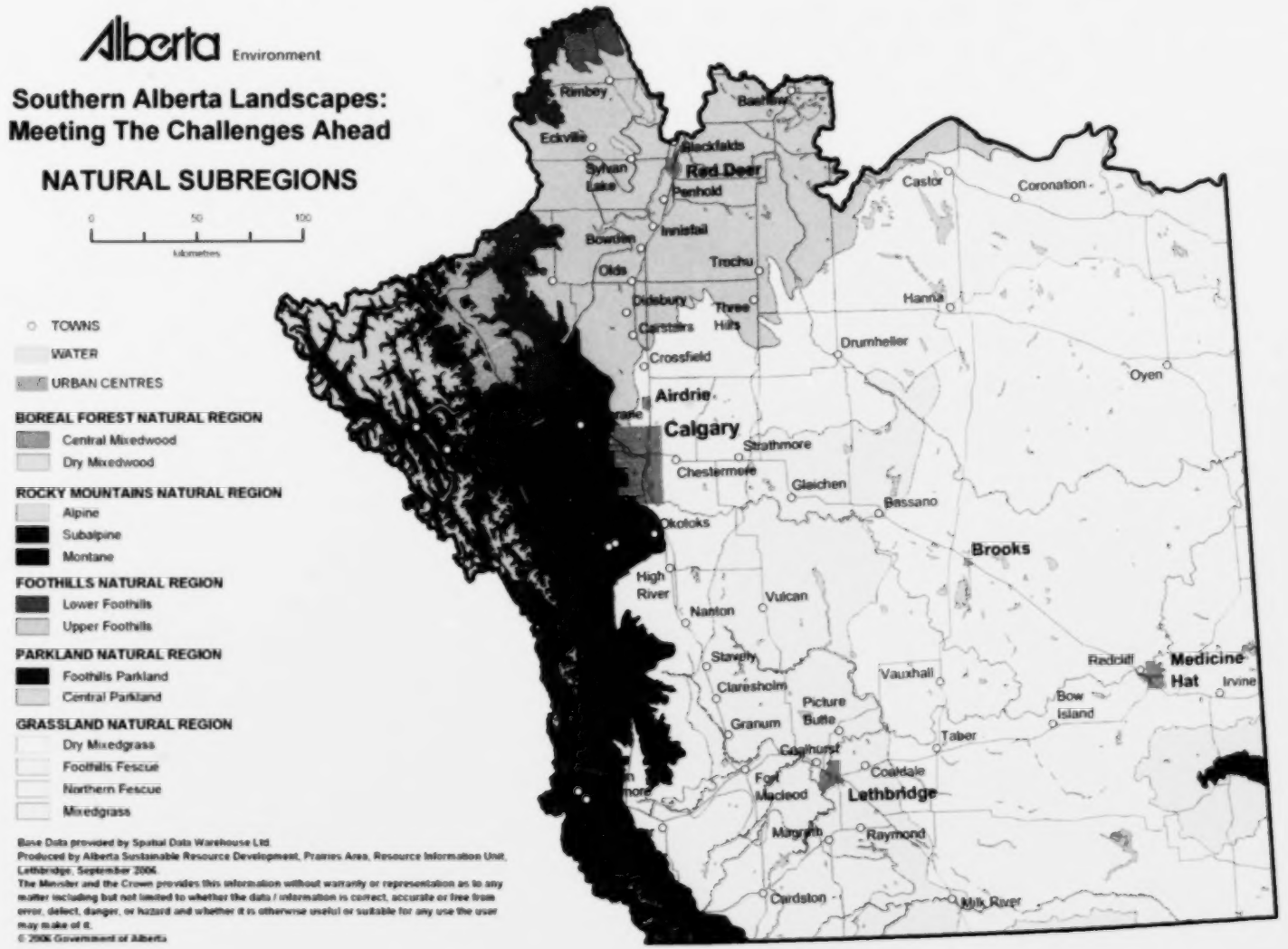


Figure 5. Natural Subregions of the SAL Region

Ecosystems and Natural Regions

A natural region (or ecoregion) is defined as a group of landscapes that contain similar landforms, hydrology, geology, soils, climate, plants and wildlife.[1] Each natural region is divided into subregions, defined as an area of land within a natural region that contains similar landscape patterns. In Alberta, there are six natural regions, with 20 subregions. The SAL area includes five of the six natural regions and 12 subregions. The largest natural region is the Grassland Natural Region (see Figure 4).

DRY MIXEDGRASS SUBREGION

The Dry Mixedgrass Subregion is the largest Grassland Subregion, covering approximately 48,000 km^2 or about 49% of the total area of the Grasslands Natural Region. The Dry Mixedgrass Subregion is generally of low relief. Elevations range from 600 metres near Empress to slightly more than 1300 metres on the lower slopes of the Cypress Hills, Sweetgrass Hills and Milk River Ridge. This subregion is the warmest and driest in Alberta.

The name "mixedgrass" comes from the predominance of both short grasses, such as blue grama, and mid-height grasses, such as spear grass, western wheat grass and June grass.

Most of this ecoregion has been altered by agricultural development. Currently, the area is mainly used for cattle production on native pasture and for crop production on irrigated land.[2]

Of the four grassland subregions, the Dry Mixedgrass Subregion contains the highest diversity of animal species. Many species, especially those of the sand dune areas and the extreme southeast part of Alberta, occur nowhere else in the province. Characteristic species of heavily grazed uplands include horned lark, McCown's longspur, chestnut-collared longspur, and Richardson's ground squirrel. Species found in lightly grazed areas include Baird's sparrow, Sprague's pipit, sharp-tailed grouse, and upland sandpiper. Sage grouse, lark bunting, Brewer's sparrow, and pronghorn prefer the sagebrush communities.

Sandy areas support some rare species, including Ord's kangaroo rat and the western hognose snake. Riparian shrublands and forests support a diverse animal community, including brown thrasher, grey catbird, yellow-breasted chat, mourning dove, northern flicker, house wren, northern oriole, deer mouse, Nuttall's cottontail, and white-tailed deer.

Rock outcrops and badlands provide nesting habitat for golden eagle, rock wren, ferruginous hawk, prairie falcon, and mountain bluebird.

Wetlands are home to many bird species, as well as to the boreal chorus frog, northern leopard frog, plains spadefoot toad, and garter snake.

MIXEDGRASS SUBREGION

The Mixedgrass Subregion covers approximately 19,000 km^2, or about 19% of the total area of the Grasslands Natural Region. The Mixedgrass Subregion typically includes gently undulating to rolling morainal and glacial lake deposits, with minor areas of steeper terrain along the lower and middle slopes of the Milk River Ridge and the Sweetgrass and Cypress Hills.

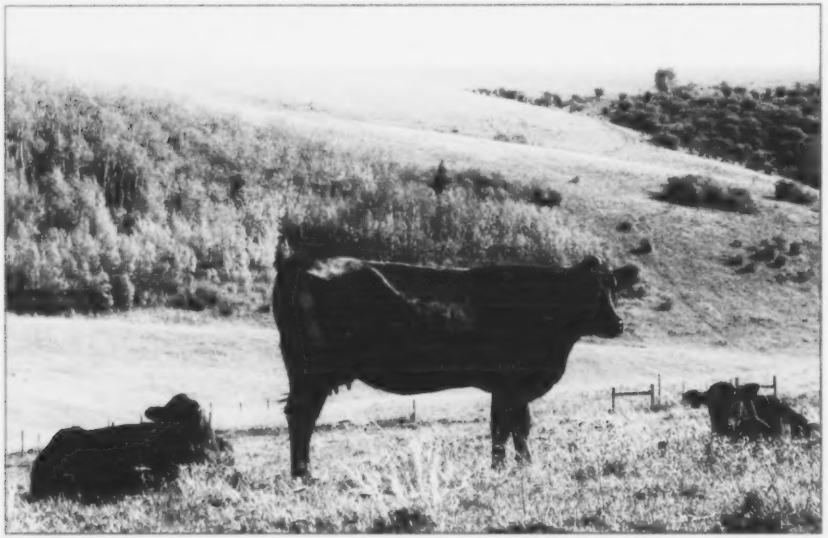
The area is currently used for irrigation and dryland farming of small grains. There is some livestock grazing, where irrigation water is not available or where the topography limits crop production.

The fauna of the Foothills Fescue Subregion is not as extensive as in the other subregions of the Grassland Natural Region.

[1] The Alberta Natural Heritage Information Centre (ACD) provides the natural region mapping for Alberta.
[2] The Ecoregions Map of Alberta, W.L. Strong and K.R. Leggatt, Agriculture Canada, 1981

Ecosystems and Natural Regions

Native grasslands in the Mixedgrass Subregion are dominated by needle grasses and wheat grasses, with many of the same forbs and dwarf shrubs that occur in the grasslands of the Dry Mixedgrass Subregion. Here, in the Mixedgrass Subregion, tall shrub and tree growth is also restricted mainly to moist draws and river valleys. Wildlife species of the Mixedgrass Subregion are similar to those discussed for the Dry Mixedgrass Subregion.



NORTHERN FESCUE SUBREGION

The Northern Fescue Subregion covers approximately 16,000 km^2, or about 16% of the total area of the Grasslands Natural Region. The Northern Fescue Subregion is characterized by gently rolling moraine and hummocky moraine. Sand plains, dune fields and glacial lake deposits also occur.

The grasslands are dominated by rough fescue. June grass, western porcupine grass, slender wheatgrass and Hooker's oat grass are also important. Common forbs include prairie crocus, prairie sagewort, mouse-ear chickweed, wild blue flax, and three-flowered avens. Wildlife species of the Northern Fescue Subregion are similar to those found in the Dry Mixedgrass and Mixedgrass Subregions.

FOOTHILLS FESCUE SUBREGION

The Foothills Fescue Subregion is the smallest subregion, covering approximately 15,000 km^2 or about 15% of the total area of the Grasslands Natural Region. The Foothills Fescue Subregion is located along the flanks of the Rocky Mountain foothills, including the Porcupine Hills, and in the Sweetgrass Hills and parts of the Cypress Hills plateau. Elevations are much higher than in the other two grassland subregions, ranging up to 1400 metres in the Cypress Hills. The fauna of the Foothills Fescue Subregion is not as extensive as in the other subregions of the Grassland Natural Region. Upland wildlife is most diverse on the extensive plateaus of the Cypress Hills and the Milk River Ridge.

Wildlife in the forests and shrublands of the southwest rivers is similar to that of the Milk River area in the Mixedgrass Subregion. Along the western edge of the Foothills Fescue Subregion, some Rocky Mountain species also occur.

PARKLAND NATURAL REGION

The Parkland Natural Region forms a broad transition between the grasslands to the south and the forests to the north. It is present only in the prairie provinces of Canada. Only the Central Parkland and Foothills Parkland Subregions occur in the SAL study area.

CENTRAL PARKLAND SUBREGION

The Central Parkland Subregion extends in a broad arc, as much as 200 km wide, between the grasslands and the boreal forest. Elevations range from 500 metres above sea level, where the Battle River enters Saskatchewan, to around 1100 metres above sea level in the west. Lakes and permanent wetlands are common.

Within this subregion, there is a gradual transition from grassland with groves of aspen in the south, to closed aspen forest in the north. Native vegetation is scarce because most land has been cultivated to grow agricultural crops. The majority of the remaining natural land is on rougher terrain or poorer soils.

Ecosystems and Natural Regions

Aspen and balsam poplar forests are the two major forest types that occur in the Central Parkland; both are characterized by a lush, species-rich understorey (the area that grows under the canopy of the forest). Within the grasslands of this subregion, plant species are essentially the same as those found in the Northern Fescue Subregion. Shrub communities of snowberry, rose, chokecherry, and saskatoon are more extensive in the northern portion of the Central Parkland Subregion. Animals of the Central Parkland Subregion include a mixture of species from the grasslands to the south and the forests to the north. Occurring at the southern edge of this subregion are grassland species such as upland sandpiper, Sprague's pipit and Baird's sparrow, which becomes less common farther north. Along the northern fringe, boreal forest species such as woodchuck, broad-winged hawk and rose-breasted grosbeak are more common. Franklin's ground squirrel and piping plover occur primarily in this subregion.

FOOTHILLS PARKLAND SUBREGION

The Foothills Parkland Subregion occupies a narrow band along the eastern edge of the foothills from Calgary south to the Porcupine Hills, and from Pincher Creek south to the U.S. border. The topography is rougher than that of the Central Parkland Subregion and elevations are higher, ranging to somewhat more than 1300 metres above sea level.

Within this subregion there is a gradual transition from grassland with groves of aspen to closed aspen forest. The transition occurs across a short distance (1 km to 5 km) because of rapid changes in topography and climate. This compression results in small geographic areas being very diverse.

Grassland communities of the Foothills Parkland Subregion are similar to those of the Foothills Fescue Subregion, supporting fescue/oat grass communities with a great diversity of forb and grass species. Aspen generally dominate the upland forests, with balsam poplar on moister sites. Willow groves form a distinctive community that occurs in the northern part of the subregion.

Many animal species occurring in the Central Parkland Subregion are absent here, but other species give the Foothills Parkland Subregion a distinctive character. Rocky Mountain species in upland forests and shrublands include dusky flycatcher, MacGillivray's warbler, lazuli bunting, and white-crowned sparrow. In the far south, black-headed grosbeaks and blue grouse are typical birds of the aspen forests.

FOOTHILLS NATURAL REGION

The Foothills Natural Region extends north, from around Turner Valley, along the eastern edge of the Rocky Mountains in a gradually widening belt. Two subregions are recognized, both of which occur in the SAL area.

LOWER FOOTHILLS SUBREGION

The Lower Foothills Subregion includes rolling topography created by the deformed sandstone and shale outcrops along the edge of the Rocky Mountains.

The forests reflect the transitional nature of this subregion, with mixed forests of white spruce, black spruce, lodgepole pine, balsam fir, aspen, white

birch, and balsam poplar. Lodgepole pine forests occupy extensive portions of the upland, especially where fire has been part of the landscape history.

Many of the animals that inhabit the coniferous forests here occur throughout the Boreal Forest, Foothills and Rocky Mountain Natural Regions. These species include the boreal chickadee, spruce grouse, ruby-crowned kinglet, white-winged crossbill, and red squirrel. Deciduous forests support ruffed grouse, warbling vireo, black-capped chickadee, and Tennessee warbler.

UPPER FOOTHILLS SUBREGION

The Upper Foothills Subregion occurs on strongly rolling topography along the eastern edge of the Rocky Mountains. Upland forests of this subregion are nearly all coniferous and are dominated by white spruce, black spruce, lodgepole pine, and subalpine fir.

Wildlife species of the Upper Foothills Subregion include pine siskin, yellow-rumped warbler, ruby-crowned kinglet, white-crowned sparrow, and varied thrush. Elk, black bear and grizzly bear are characteristic mammalian species. The diversity of animal species is less here than in the Lower Foothills Subregion because of a reduced diversity of plant communities.

ROCKY MOUNTAIN NATURAL REGION

The Rocky Mountain Natural Region along the Continental Divide ranges from about 10 km wide in the Waterton Lakes National Park area to more than 100 km wide in the central portion of the region. It contains the most rugged topography in Alberta. All three subregions of this natural region are represented in the SAL area.

SUBALPINE SUBREGION

The Subalpine Subregion occupies a band between the Montane and Alpine Subregions in the south and between the Upper Foothills and Alpine Subregions in the north.

The lower subalpine is characterized by closed forests of lodgepole pine, Engelmann spruce and subalpine fir; the upper subalpine has open forests near the treeline. Whitebark pine forests occasionally occur and subalpine larch is found south of Bow Pass. High elevation grasslands occur on steep south- and west-facing slopes. Snow avalanches create a diverse mix of shrubby and herbaceous communities.

Present uses include watershed protection, forest management, national parks, recreation, and wildlife habitat.

Wildlife species of the coniferous forests include spruce grouse, gray jay, pine siskin, boreal chickadee, marten, snowshoe hare, black bear, deer mouse, and red squirrel. Subalpine forest birds and mammals that are restricted to the Rocky Mountain Natural Region include the Stellar's jay, varied thrush, Townsend's warbler, willow ptarmigan, golden-crowned sparrow, and mountain caribou.

ALPINE SUBREGION

The Alpine Subregion occurs above treeline and includes vegetated areas, bare rock, snowfields, and glaciers. Alpine vegetation is diverse. Deep, late-melting snowbeds are occupied by black alpine sedge communities. Moderate snowbed communities are dwarf-shrub heath tundra, which is dominated by heathers and grouseberry. Shallow snow areas on ridgetops

and other exposed sites contain communities dominated by white mountain avens, snow willow and moss campion. Diverse, colourful herb meadows occur in moist sites below melting snow banks or along streams. Lichen communities on rocks struggle to survive at the highest elevations.

Present uses of the Alpine Subregion include watershed management, recreation and wildlife habitat.

MONTANE SUBREGION

The Montane Subregion in southern Alberta occurs on east-west trending ridges that extend out from the foothills. To the north, this subregion occurs mostly along the Bow River Valley.

The montane landscape is characterized by a pattern of open forests and grasslands. Open forests, dominated by Douglas fir and limber pine on the ridgetops, are among the driest forest communities in Alberta. These communities are species-rich, reflecting the diversity of habitats. Limber pine grows on the most exposed rock outcrops. Lodgepole pine forests occur on upland sites. White spruce forests grow along streams and aspen forests are typically found on terraces. Bluebunch wheat grass, fescue grasses and oat grasses, plus a great diversity of forbs, typically dominate the Grasslands.

Douglas fir - limber pine habitats are home to blue grouse, mountain chickadee, Clark's nutcracker, mule deer, elk, and Columbian ground squirrel. Aspen forests typically contain MacGillivray's warbler, warbling vireo and lazuli bunting. Spotted frog and long-toed salamander, found in wetlands in this subregion, are restricted to the Rocky Mountain Natural Region in Alberta.

BOREAL FOREST NATURAL REGION

The Boreal Forest Natural Region is Alberta's largest Natural Region. It consists of broad lowland plains and discontinuous hill systems. The presence of extensive wetlands is also a major characteristic. Bogs, fens, swamps, and marshes are common. While the Boreal Forest Natural Region has six subregions in Alberta, only one, the Dry Mixedwood Subregion, is found in the SAL region, in the northwest corner.

DRY MIXEDWOOD SUBREGION

The Dry Mixedwood Subregion is characterized by level to undulating terrain. The vegetation is transitional between that of the Central Parkland and Central Mixedwood Subregions found to the north and outside the SAL region. Aspen occurs in both pure and mixed stands. Balsam poplar frequently occurs with aspen, especially on moister sites. White spruce and balsam fir may replace aspen and balsam poplar. Coniferous species are more common farther north, with widespread mixed stands of aspen and white spruce.

Aspen forests have a diverse understorey. Coniferous forests generally have a less diverse understorey, but a greater cover of moss species. Dry, sandy uplands are usually occupied by jack pine forests. These may be quite open and may have a prominent ground cover of lichens. Peatlands are common, but not as prevalent as in other boreal forest subregions.

Characteristic wildlife species of the deciduous forests include least flycatcher, house wren, northern oriole, and rose-breasted grosbeak. Species of the mixedwood forests include yellow-bellied sapsucker, Swainson's thrush, magnolia warbler, white-throated sparrow, pileated woodpecker, and northern goshawk.

▸▸ Watersheds

Water is a constant concern in the landscape in the SAL region, where 80% of the province's population has access to just 20% of the province's water.[1]

Urban municipalities, including Calgary and the 'Four Cities,' now make up more than 90% of the estimated 1.5 million people presently reliant on drinking water from the South Saskatchewan River Basin (SSRB). The steady, significant urban growth in Calgary and the 'Four Cities' means increasing demands are being placed on the rivers and tributaries of the SSRB.

Due to the increasing demand on water resources, the diminishing capacities of private sources, and increasingly higher industry standards and public expectations of water quality, many smaller communities are looking to the larger urban municipalities for partnerships in regional water facilities.

HISTORY

During the Pleistocene period in geological history, from 1.6 million years ago to about 10,000 years ago, major ice sheets scoured the landscape of western Canada as they advanced and retreated over several ice ages. The immense runoff from the last retreat of the glaciers, some 10,000 years ago, shaped southern Alberta's watersheds. It changed the course of some rivers and deepened all their channels, a process that has continued with the erosion of the soft, sedimentary bedrock. Except for isolated igneous outcrops in the Milk River watershed, all exposed valley bedrock in the SAL region is composed of soft sedimentary rocks. Erosion has etched each of the main river valleys with numerous coulees and ravines, with badlands forming where the bedrock has been deeply carved.

During the last 10,000 years, periodic floods and drought have affected southern Alberta's rivers and other surface waters. Indications from scientific studies are that severe droughts have occurred during the past 2000 years, with an average duration of more than 10 years. At least 20 short droughts occurred during the 20th century. The drought of the 1930s, with subsequent "dust bowl" conditions, is the most notable from the early part of the century and was the most severe and prolonged drought since the beginning of western settlement. Its impact on the economy and the life of prairie settlers was magnified, as it coincided with the worldwide economic depression. Another dry period that was to last about 10 years began in 1977. The 2001-2002 drought had the driest back-to-back years in 74 years.

SURFACE WATER

Water management in the SAL region is concerned primarily with the three main sub-basins of the SSRB – the Oldman River Basin, the Bow River Basin, the Red Deer River Basin – and the Milk River Basin (see figure 6). Of this total land surface, rivers, streams, lakes and man-made reservoirs occupy only 248 km^2, or about 2% of the total area of the approximately 112,500 km^2 in the SAL region.

Natural drought cycles, glacial shrinkage and climate change predictions have all led to concerns about possible shortages in water supplies in the future. Alberta Environment has studied historical flows in the major river basins in the SAL region in response to these concerns. While flow rates in the SSRB have fluctuated during the years, the average natural flow has not changed much. However, such flow volumes cannot be assured in the future. If climate change predictions prove accurate, higher temperatures on the prairies will mean more evaporation from rivers, reservoirs and fields. Historic records also indicate the 20th century was wetter than usual and that, if pre-20th century patterns return, more prolonged droughts exacerbated by climate change might be expected in the future.[2]

[1]Based on 'SSRB Non-irrigation Water Use Forecasts', Canadian Resource Economics Ltd. and Hydroconsult EN3 Services Ltd., 2002
[2]The State of Southern Alberta's Water Resources, Confronting Water Scarcity conference, 2004

Watersheds

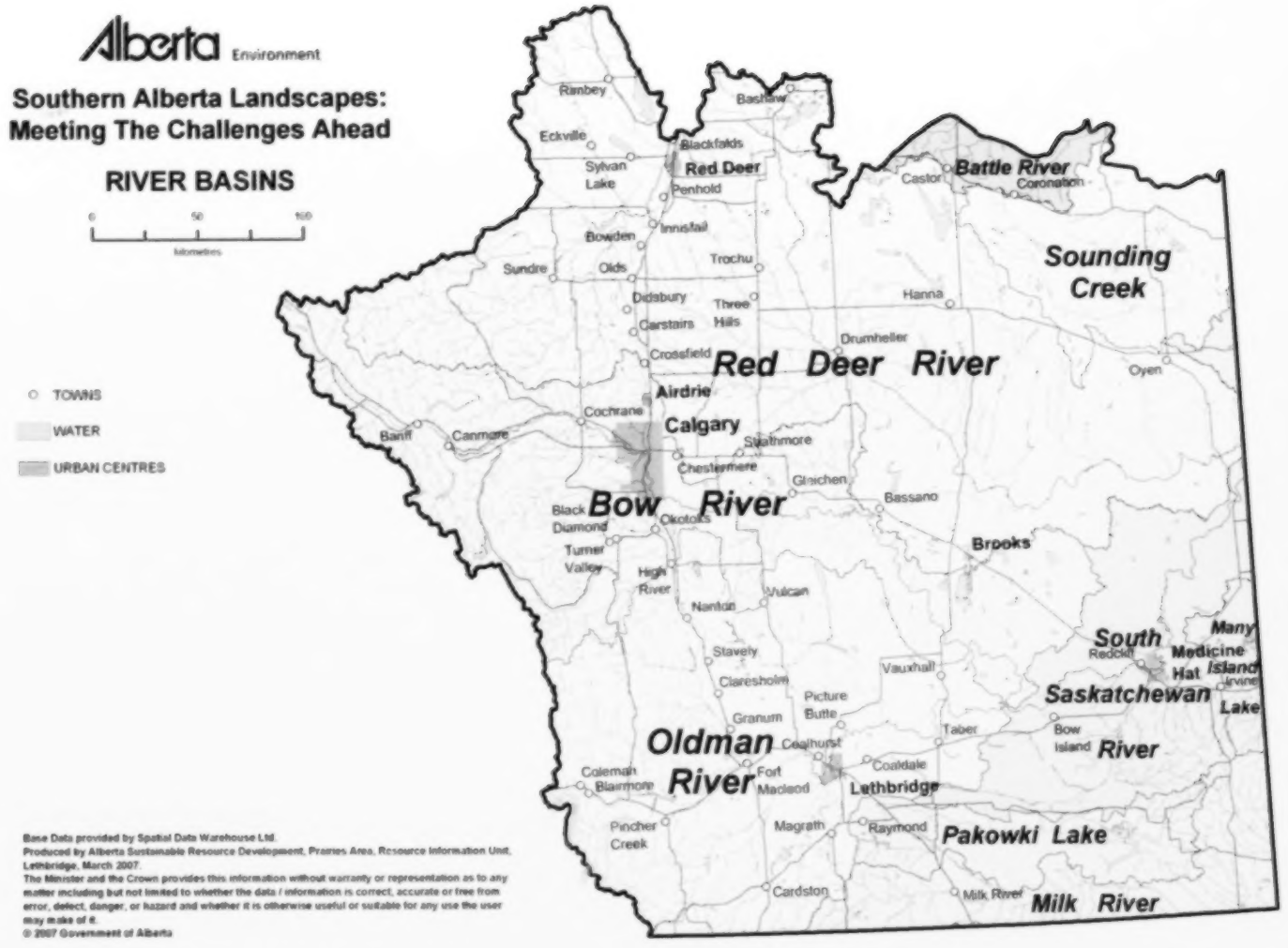


Figure 6. Map of River Basins

▸▸ Watersheds

SOUTH SASKATCHEWAN RIVER BASIN

The South Saskatchewan River Basin is a diverse landscape, including parts of the Rocky Mountain, Foothills, Boreal Forest, Parkland and Grassland natural regions. The combination of fertile soils and dry climate in the southern part of the basin has led to the development of irrigation farming. All of the province's 13 irrigation districts are located in this basin.[3]

As well, the watershed supports about half the province's population. The bulk of the SSRB's stream flow, about 75% of the volume of the Oldman, Bow and Red Deer Rivers combined, originates in the Rocky Mountains' eastern slopes. These flows arise as melt water from snow packs and glaciers, augmented by seasonal runoff. Thus, natural river flows are highest in spring and early summer, taper off in the fall, and remain low over the winter.
The combined watershed of the SSRB basins is 121,095 km^2, of which 41% is from the Red Deer sub-basin, 22% from the Oldman, 21% from the Bow, and 16% from the South Saskatchewan sub-basin. The mean annual discharge from the SSRB into Saskatchewan is 9,460,000 dam^3 (cubic decametres), representing about 7% of Alberta's total river flow.[4]

The average contributions of each of the rivers to the total flow is 43% for the Bow River, 38% for the Oldman River, 18% for the Red Deer River, and 1% for the lower South Saskatchewan River (below the confluence of the Bow and Oldman Rivers).

Glaciers found in the mountainous headwaters of southern Alberta's rivers are important to the region's water cycle. While annual snowmelt and precipitation provides the bulk of stream flow in the spring and early summer, flow from melting glaciers also contributes and becomes more important in the late summer. Studies carried out in the headwaters of the Bow River Basin have indicated that melt water from glaciers generally contributes about 2.5% of the annual flow of the Bow River at Banff, but may be as high as 9% in dry years. In the late summer, the contribution can be as much as 40% of the flow in extremely dry years.

As in other parts of the world, the glaciers of the southern Canadian Rockies are retreating. In the period since the last cold period (the Little Ice Age of the second millenium), the shrinkage of these glaciers has been in the order of 25% to 75%. This trend has raised concerns about potential impacts on water supplies in the SAL region.

The upper cold water reaches of the South Saskatchewan river system contain mountain and lake whitefish and many kinds of trout: – bull, brook, brown, cutthroat, golden, lake, and rainbow. Downstream reaches contain northern pike, goldeye, mooneye, yellow perch, walleye, sauger, and lake sturgeon.

[3] State Of the Environment, Aquatic Ecosystems, 1996
[4] Alberta Environment, http://www3.gov.ab.ca/env/water/basins/basinform.cfm?basins=10

Watersheds

The Red Deer River sub-basin, which includes portions of Foothills, Boreal Forest, Parkland and Grassland natural regions, contains the largest number of lakes and wetlands. The other sub-basins, situated (apart from their headwaters) primarily in the Grassland Natural Region, contain only a few natural lakes, including Tyrrell Lake near Lethbridge and Eagle Lake near Strathmore. Both these lakes and others in the Grassland Natural Region are shallow, saline, and high in nutrients.

These rivers and their tributaries are the only supply for most water needs in the Grassland Natural Region. Groundwater is in insufficient supply and often of poor quality. Heavy agricultural use takes place along the south flowing tributaries downstream from Finnegan. North flowing tributaries are used as return flow channels for the irrigation districts. Towns and cities, such as Sundre, Red Deer, Drumheller, and Bindloss, use the Red Deer River for their water supply.[5]

Water allocation licences in the SSRB have been issued since 1894. Between 1894 and 1931, the Federal Government issued licences under the Northwest Irrigation Act. After 1931, licences were issued by the province. The legislation has supported four principles of allocation since 1894. These are:

- The Crown owns the water,
- Allocations are designed to promote development,
- Licences will be issued for allocations, and
- There will be a priority system for all allocation.

The 1999 Water Act confirmed these principles and instituted new approaches based on conservation and water management planning.

On August 30, 2006, the Government of Alberta announced a new water management plan for the SSRB. Alberta Environment will no longer accept new water licence applications for the Bow, Oldman, and South Saskatchewan sub-basins. Water allocations may still be obtained through water allocation transfers. The SSRB plan was developed to safeguard existing water user's supply while protecting the aquatic environment, as outlined in Water for Life: Alberta's Strategy for Sustainability. More information on Water for Life and the South Saskatchewan River Basin Water Management Plan is available at www.environment.gov.ab.ca.

[5] South Saskatchewan River Basin: Water Allocation, Alberta Environment, May 2003 (Revised January 2005) www3.gov.ab.ca/env/water/regions/ssrb/pdf_phase2/SSRBWaterAllocations_Jan2005.pdf, and Alberta State of the Environment, Aquatic Ecosystems, 1996

Watersheds

Table 1 shows the percentage of water currently allocated for different uses in the SSRB.

Table 1. SSRB Water Allocations

Water Use	% Used
Irrigation	74.58%
Agricultural	1.72%
Commercial	3.73%
Deadfish Sheerness	0.16%
Dewatering	1.25%
Habitat Enhancement	0.68%
Gas/Petrochemical Plants	0.01%
Oilfield Injection	0.91%
Management of Fish	0.31%
Management of Wildlife	<0.01%
Municipal	13.42%
Other Purposes	<0.01%
Recreation	0.28%
Registration	0.07%
Water Management	2.83%

OLDMAN RIVER BASIN

The Oldman River flows for 450 km, from its headwaters in the Rocky Mountains through rangelands in the foothills and eastward across the arid prairie. It is similar in size to the Bow River Basin, with an area of about 26,000 km^2, constituting nearly 24% of the total area of the SSRB. The basin includes three major tributaries – the St. Mary, Belly and Waterton Rivers. The Oldman River Dam, a major impoundment on the main stem, is located near Pincher Creek. The water supply diversion for the Lethbridge Northern Irrigation District is located upstream of Fort Macleod. One hundred and ninety kilometres downstream of the Oldman River Dam, the river flows through the City of Lethbridge. Between Lethbridge and the "Grand Forks", the confluence of the Oldman and Bow Rivers, the river is warm and turbid.

BOW RIVER BASIN

The Bow River flows for about 625 km, from its headwaters in the Rocky Mountains to its confluence with the Oldman River. It constitutes nearly 23% of the total area of the SSRB, with a total area of about 25,000 km^2. Impoundments for hydroelectric generation are located in the upper reaches of the basin and just upstream of the City of Calgary. In its middle reaches, the river continues to be fast flowing, moving over a rocky substrate, but the flow is affected by development in and around the City of Calgary. In the middle of the urban area, the first major diversion for irrigation provides a water supply for the Western Irrigation District. The reach of river downstream of the city is highly productive, supporting a world-class sport fishery. The river continues to flow across the prairie landscape, with major diversions for irrigation water supplies at the Carseland weir, for the Bow River Irrigation District, and at the Bassano Dam, for the Eastern Irrigation District. The lowest reaches of the river are warm, shallow and eutrophic (nutrient enriched and oxygen poor).

RED DEER RIVER BASIN

From its headwaters in the Rocky Mountains, the Red Deer River flows 708 km to the Alberta-Saskatchewan border. With a watershed area of about 47,000 km^2, it constitutes more than 42% of the total area of the SSRB and is the largest of the three sub-basins. There is one major impoundment on the Red Deer River, the Dickson Dam near Innisfail. Completed in 1983, the dam provides a reliable, year-round water supply for industry and municipalities in the Red Deer River Basin. It also improves water quality, and increases Alberta's ability to meet its apportionment agreement with Saskatchewan. There is little development in the upstream reaches, which are largely forested watershed. Below the Dickson Dam, the river flows through the City of Red Deer and is affected by municipal effluents. Farther downstream, the river receives inflows from the Medicine and Blindman Rivers, which carry natural organic materials from their headwaters and runoff from agricultural lands. The lowest reaches are slower moving and subject to high sediment loads from the badlands area.

THE BATTLE RIVER BASIN

Located within the Parkland Natural Region, the Battle River Basin is a key watershed in east-central Alberta. It is a sub-basin of the North Saskatchewan River Basin.

Geographically, the basin covers approximately 30,000 km^2, with 25,000 km^2 within Alberta's borders. Rich and diverse in plant and animal life, the basin's water supply is derived entirely from local surface runoff (rain and snow melt) and from groundwater flows, without the benefit of the mountain/foothill snow packs and glacial melt that contribute to many of the other river basins in the SAL region.

Maintaining water quantity and quality in the Battle River Basin is an ongoing challenge given the river's low flow volumes, the natural conditions of the basin and the cumulative impact of municipal, industrial and agricultural activities.[6]

SOUNDING CREEK BASIN

The Sounding Creek Basin originates in headwaters south of the Town of Castor and flows for approximately 370 km. The total drainage area for the watershed area of Sounding Creek, including the area that drains directly to Sounding Lake, is 8220 km^2. The basin forms part of the Special Areas Zone of the province and is considered to be water short. Land use within the basin is primarily agricultural grazing land for the production of cattle. The vegetation is predominantly in grasses. While the soils are widely classified as irrigable within the basin, the limited availability of water restricts irrigation to just a few backflood or surface irrigation projects.

THE MILK RIVER BASIN

The Milk River Basin is found in the southernmost part of the province. It is the smallest major river basin in the province, draining about 6500 km^2 in the arid Grassland Natural Region, or about 1% of the provincial land mass. This river basin is the most northerly part of the vast Missouri-Mississippi River Basin of the United States. It starts southeast of Cardston, where the Milk River enters Alberta from Montana, flows eastward across the prairie landscape for about 170 km, and then flows back into Montana south of Medicine Hat. In the lower reaches sediment load increases significantly due to erosion of unstable badland slopes. This gives the lower river its milky colour. The westernmost portion of the basin is extensively cultivated. Farther east, the major land use is cattle ranching and cattle feedlots are common.

Dryland crops predominate, with some irrigated crops also grown. The Cypress Hills occupy the northeast corner of the basin. With no cities and few towns, the basin has a population of fewer than 2500 people.

The amount of water allocated in the basin, 41 million metres^3, is less than 1% of the total water allocation in the province. This water is used mostly for irrigation and to a lesser extent other agricultural uses. The Milk River's annual average flow is about 1,000 million cubic metres (100,000 dam^3) when it enters Alberta, and about 160 million cubic metres (160,000 dam^3) when it leaves the province.

LAKES AND RESERVOIRS

Lakes are scattered throughout the SAL region, ranging in surface area from tens of square kilometres to just a few hectares. The natural permanent lakes of the region formed in the large depressions and blocked waterways left by

[6] Alberta Environment, http://www3.gov.ab.ca/env/water/regions/battle/

the retreating ice sheets. They include Buffalo Lake, Pine Lake, Sylvan Lake, Bow Lake, Lake Louise, Crowsnest Lake and Waterton Lake. Man-made weirs maintain the water levels of some lakes including Little Fish Lake, Beauvais Lake, and Elkwater Lake in the Cypress Hills. Man-made diversions have raised water levels in others including Gull Lake, Namaka Lake and Reesor Lake.

Major onstream reservoirs in the SAL region include the Oldman Reservoir, the Ghost Reservoir and Glennifer Lake (formed by the Dickson Dam). Major offstream reservoirs include Lake McGregor, Lake Newell, Keho Reservoir, Travers Reservoir and the Chain Lakes. Onstream reservoirs are created when the flow of a major stream is blocked by the construction of a dam, creating a water storage area. Off-stream reservoirs are created when a structure is built across a minor stream or coulee to form a storage area for water diverted from outside its natural drainage basin.

IRRIGATION CANALS

Using their length and width as measures, irrigation canals occupy about 30 km^2 of the SAL region – about half the area occupied by natural streams. These canals are confined by steep banks lined with clay, gravel or cobbles, and in many cases plastic, to prevent losses of water through seepage. The main canals are generally about 10 metres wide and the smaller lateral canals average about 3 metres in width. River flows are diverted into irrigation canals during the growing season, from early May until late October, with flows fluctuating, depending on changing demands for water. Between October and May, the canals are dry except for natural rainfall and snowmelt. The canals are managed to ensure efficient water conveyance, including flushing of sediments and control of aquatic vegetation. As a result, they provide only marginal habitat for wildlife. Fish that are swept through the diversion structures and into canals generally do not survive.

SURFACE WATER ALLOCATIONS

The SAL region's water supplies are subject to both interprovincial and international agreements. Under a 1969 interprovincial agreement, Alberta is required to pass approximately 50% of the South Saskatchewan River Basin's natural flow to Saskatchewan and to ensure the departing flow meets certain water quality guidelines. About 55% to 75% of annual natural discharge will typically be delivered to Saskatchewan on an annual basis. An increase in frequency of flows in the lower range is expected due to increasing utilization of existing licences and additional allocation from the Red Deer River in the future. In wet years volumes in excess of 80% will continue to be passed to Saskatchewan.

Alberta remains committed to meeting all of its apportionment obligations to Saskatchewan. A committee is being formed that will include representatives of each Alberta SSRB sub-basin to advise on measures to meet Alberta's needs in dry years and respect apportionment.

Similarly, apportionment agreements between Canada and the United States (the Boundary Waters Treaty of 1909 and the Order of the International Joint Commission in 1921) entitle Canada to 50% of the natural flow of the Milk River during the winter. From April to October, Canada is entitled to 25%.

The Government of Alberta owns the rights to all waters within its borders and allows water to be diverted and used by licence holders. It allocates these licences on a first-in-time, first-in-right basis, which means that in times of shortage, the older the license, the higher its priority for receiving water, regardless of the purpose for which the water was allocated. Some licences date back to 1894, when water resources were controlled by the federal government.

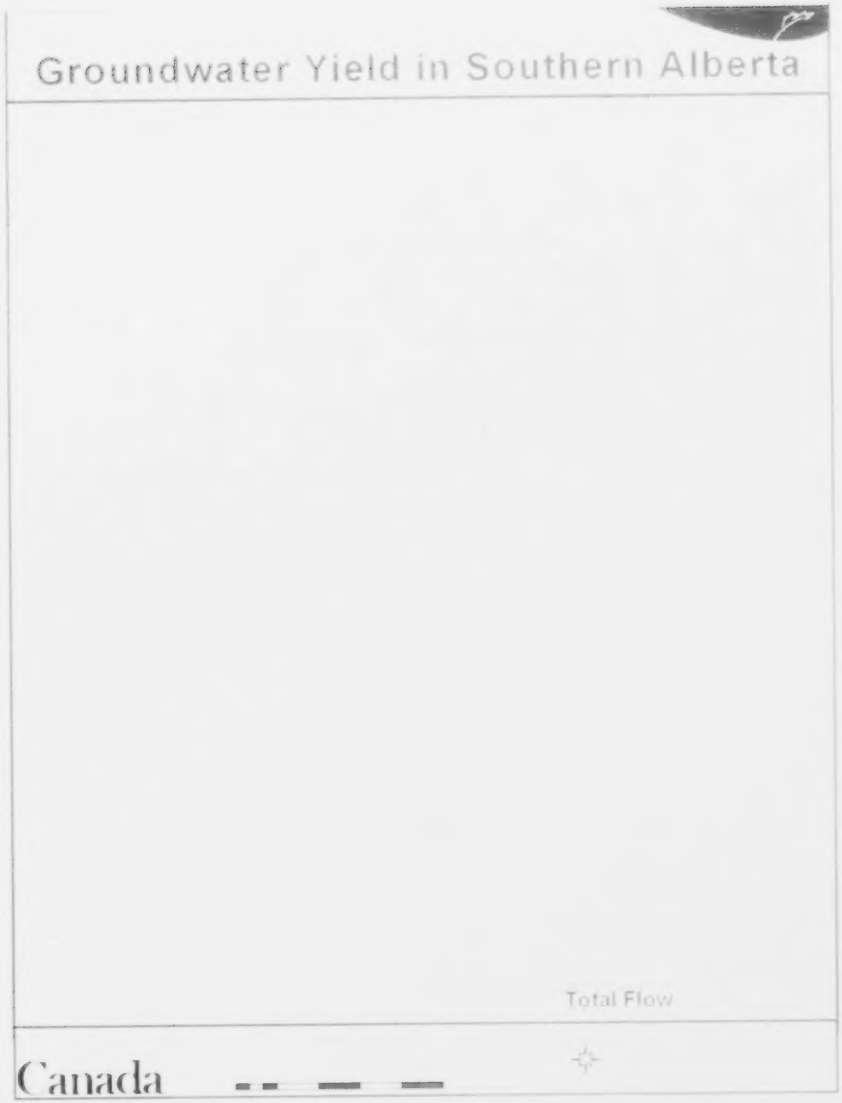


Figure 7: Groundwater Yield in Southern Alberta

Figure 8: Total Dissolved Solids in Southern Alberta Groundwater

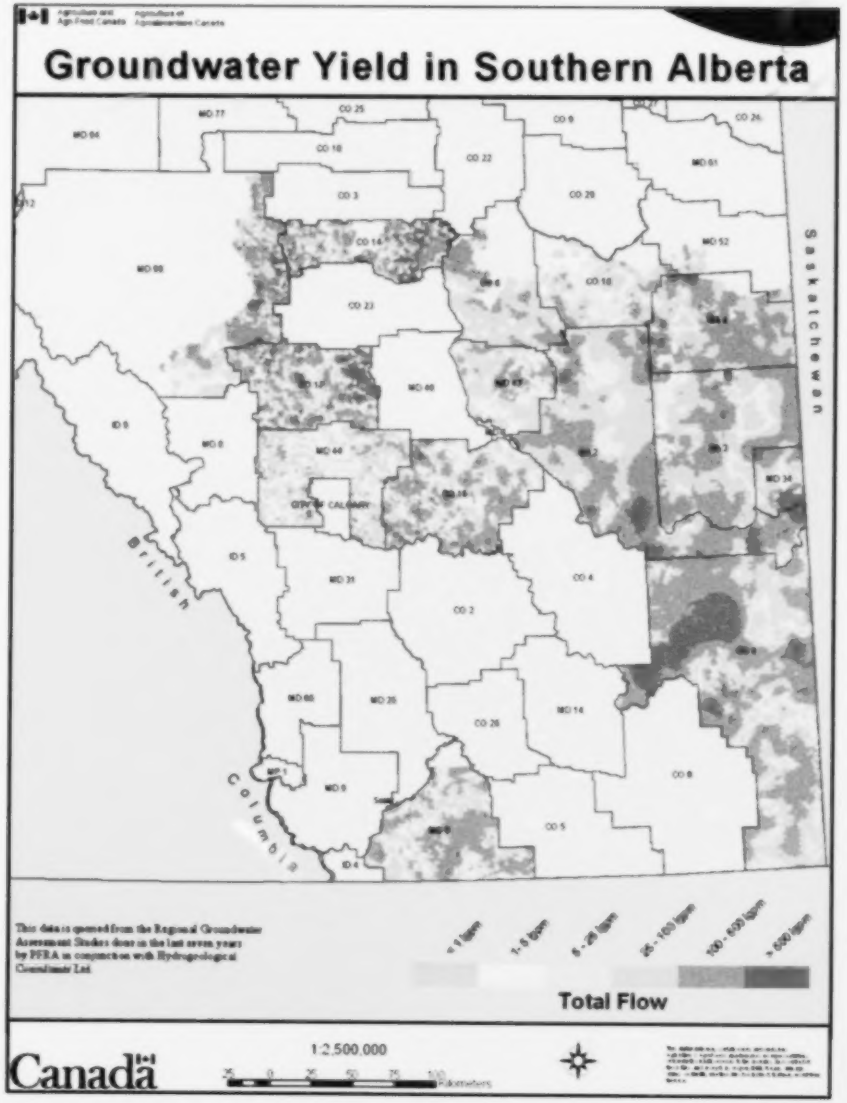


Figure 7. Groundwater Yield in Southern Alberta

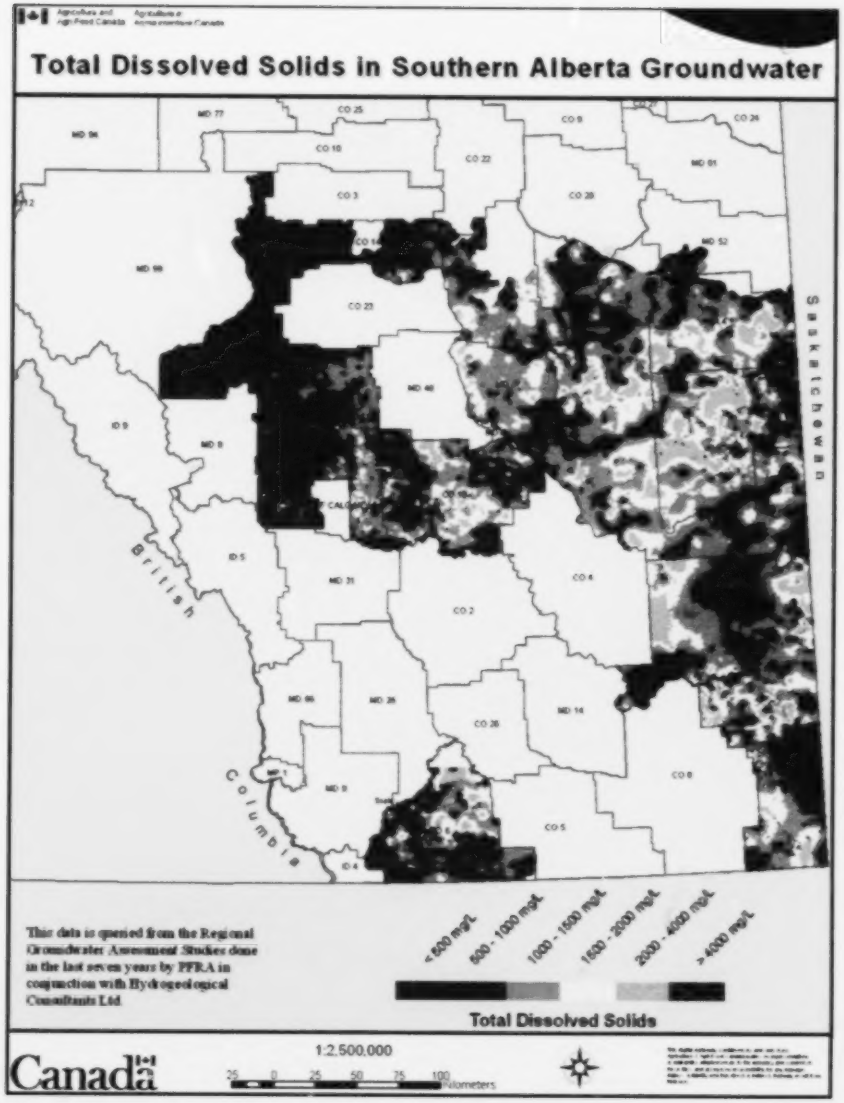


Figure 8. Total Dissolved Solids in Southern Alberta Groundwater

Watersheds

There are approximately 20,000 licences and registrations in the SSRB, accounting for 61% of all the water allocated in Alberta. In the SSRB, irrigation accounts for 75% of the allocation volume (more than 3.8 million dam^3 of water), followed by municipalities (13%), industry (3.7%) and other agricultural uses (1.7%). A total of approximately 600,000 hectares of land in SAL are irrigated.[7]

GROUNDWATER RESOURCES

Groundwater is water in the pore spaces in subsurface sediments and rocks. Aquifers are subsurface layers, such as sand, gravel and sandstone, in which groundwater is plentiful enough to be used as a water supply. Aquitards are sediments such as clay, shale and deep clay-rich glacial till, through which groundwater moves so slowly it cannot be used as a water supply.

Farm acres on which commercial pesticides and fertilizers are used have almost tripled in Alberta in the last 25 years, and cattle numbers increased by 25% between 1991 and 1996. As agriculture becomes more intense, incidences of agricultural contamination of groundwater are increasing. The influence of irrigated agriculture on groundwater quality in Alberta was assessed by several studies conducted by Alberta Agriculture, Food and Rural Development in the 1990s. The results indicate a high potential for contamination of shallow aquifers in areas with intensive agriculture.

Shallow groundwater is used by many farm families, and is therefore a valuable resource that requires protection. Once aquifers become contaminated, remediation is extremely difficult and expensive. In addition, discharge of contaminated shallow groundwater that occurs either naturally or through subsurface tile drain effluent can add significant amounts of contamination to surface water. Finally, contaminants in shallow groundwater may leach to deeper groundwater over long periods of time.

From the early 1970s to the early 1980s, the Alberta Research Council (ARC) systematically mapped the groundwater resources in Alberta.

Since 1996, Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration (AAFC-PFRA) has been partnering with municipalities to map their groundwater resource at a regional scale. These new studies are based on additional water well data that has been accumulated by Alberta Environment since the 1980s. Figure 7 is a mosaic of the groundwater yield for 17 municipalities from 14 of those reports. Figure 8 shows groundwater quality with regard to Total Dissolved Solids only. Mapping of groundwater in the SAL region is not complete.

Even if these groundwater supplies have adequate yields for a particular use, they may not have the water quality required. Many groundwater supplies in southern Alberta are high in salt, due to natural sources in sediment. Hence, most groundwater supplies in the SAL region are not suitable for irrigation because excess salinity (total salt content) and sodicity (sodium) in irrigation water can reduce crop productivity.[8]

[7] State of Alberta's Water Resources, 2004 and Alberta Agriculture, Food and Rural Development, Irrigation Branch, Lethbridge, June 1, 2005. 496,000 hectares are irrigated through the thirteen irrigation districts in southern Alberta, and 110,000 ha are privately irrigated.

[8] Agricultural Impacts on Groundwater Quality in the Irrigated Areas of Alberta, Alberta Agriculture, Food and Rural Development
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/irr4452?opendocument

Groundwater quality is best represented regionally by Total Dissolved Solids (TDS), which is a measure of the relative mineral content of the water. Canadian guidelines set an aesthetic level for TDS at 500 milligrams per litre (mg/L). However, many wells in Alberta produce safe, potable water in the 500 – 1000 TDS range and even the best water quality in any given area tends to be above 500 TDS. As Figure 8 shows, there is a general water quality trend from west to east, with better quality in the west and poorer quality in the east. The most significant areas to note are those that are coloured yellow and orange. As with the yield maps, however, these are regional trends and local conditions may differ, for better or for worse.

GROUNDWATER YIELD

Figure 7 indicates the cumulative 20-year safe yield of all aquifers occurring to a depth of 500 feet. It shows the amount of water that can be safely withdrawn, in a given area, if all available aquifers are utilized.

Typically, groundwater use can be divided into two categories, domestic (or low) use and higher use required by farming or industry. Daily domestic use normally averages about 1.1 m^3/day (This is equivalent to 240 imperial gallons per day, the value used on the Groundwater Yield map, Figure 7). In reality, to keep up with peak daily demands, yields greater than 6m^3 of water per day are usually required for domestic use. Any demand for groundwater in addition to domestic use is likely to require much greater yields.

The Groundwater Yield Map shows lower yield levels occurring mostly in the east and south regions, with areas of higher yield throughout. There is also a region with generally higher yields in the Lacombe/ Red Deer area.

WATER QUALITY[9]

The SAL region is characterized by low water flows relative to population pressures. The major areas of concern are:

- Increases in total loadings of such solids as nitrogen, phosphorus and sediments,
- Non-point source loadings from agriculture, including manure,
- Regulation of point source loadings, and
- Safety of drinking water.

Water quality measurements in the SAL project documents are represented as an index that simulates relative change based on:

- Export of nutrients and sediment from landscape types (vegetative) and footprints (mostly non-vegetated) in kilograms per hectare per year (kg/ha/yr), and
- Total amount of water in the system.

The Alberta Water Quality Index includes measures of bacteria, metals, pesticides and nutrients.

OLDMAN RIVER WATER QUALITY

Water quality in the Oldman River Basin has improved downstream of Lethbridge since 1999, as a result of upgraded municipal wastewater treatment. The Alberta Surface Water Quality index rates water quality near Brocket, upstream of Lethbridge, as excellent, or "best" quality. Upstream of Lethbridge at Highway 3 and downstream of Lethbridge at Highway 36, water quality is rated good, though guidelines are occasionally exceeded, usually by

[9] Alberta Environment, 2005

small amounts. Pesticide detections were slightly higher downstream in 2003/04. Water quality during very high river flows, such as those experienced in 2002/03 and again in 2005, show elevated nutrient and bacteria values when measured during late spring when there is increased runoff and non-point source loading.

In Reporting Year 2003/04, the Alberta Water Quality Index near Brocket was 100; upstream of Lethbridge it was 90 (good), and downstream 89.

BOW RIVER WATER QUALITY

Water quality measured at Cochrane, upstream of Calgary, is better than downstream. Upgraded municipal wastewater treatment, including full disinfection (1997), has resulted in improved conditions downstream. The pesticide index is also slightly lower downstream. A slight decrease in the upstream index in reporting period 2003/04 is due to increased spring nutrient concentrations; a similar downstream decrease reflects a small increase in pesticide detections and spring bacteria values.

In Reporting Year 2003/04, the Alberta Water Quality Index upstream of Calgary near Cochrane was 98 (excellent) and downstream of Calgary at Carseland was 90 (good).

RED DEER RIVER WATER QUALITY

Water quality is slightly better upstream of Red Deer, relative to downstream site measurements. However, upgraded wastewater treatment installed in 1999-2000 has resulted in generally improved downstream conditions.

In Reporting Year 2003/04, the Alberta Water Quality Index upstream of Red Deer, at Fort Normandeau, was 94 (good); at the downstream site at Morrin Bridge the index was 89. The slight decrease in the index compared to the previous year was the result of higher nutrient and metal concentrations during spring run-off, and, at the downstream site, to slightly more frequent pesticide detections.

Airsheds

Airsheds are geographic areas that, because of emissions, topography and meteorology, typically experience similar air quality. Air quality is important to Albertans and is an integral part of the southern Alberta landscape.

Air quality is a measure of how clean the air is. Substances such as carbon monoxide, ozone, sulphur dioxide and hydrogen sulphide are considered to be air pollutants when concentrations in the air are high enough to cause adverse effects. A number of natural and anthropogenic sources release substances to the air. When they accumulate in the atmosphere, air quality is reduced and both human and ecosystem health can be affected.

In Alberta, the Air Quality Index is used to measure general air quality. This index associates concentrations of five major air pollutants to provincial air quality objectives and federal air quality objectives. Concentrations of carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide and fine particulate matter are used to determine whether the quality of the air is Good, Fair, Poor, or Very Poor. Figure 9 shows long-term air quality trends in the major population centres within the SAL area, where data is available.

HISTORY

Over the past two decades, there have been a number of improvements in air quality control and monitoring technologies. These improved technologies have led to improvements in air quality, especially in urban centres. In fact, levels of many air pollutants have shown significant declines, as reported by the Clean Air Strategic Alliance.

For example, in downtown Calgary, from the early 1980s to the year 2000, carbon monoxide concentrations have decreased by 65%, nitrogen dioxide levels have decreased by 38%, lead concentrations have decreased by 98%, and inhalable particulate values have decreased by 46%. Inhalable particles refer to those capable of entering the human respiratory tract.

Figures 10-13 show annual average concentrations for carbon monoxide, ozone, sulphur dioxide, and hydrogen sulphide. The accumulation of pollutants, no matter the source, depends on the rate at which they are emitted into the atmosphere and how quickly they are dispersed. The dispersion of pollutants is influenced by wind, temperature, turbulence, and the changes in these factors caused by local topography.

AIRSHED ZONES

In Alberta, air quality is monitored and managed by the Clean Air Strategic Alliance (CASA). CASA was established in March 1994 as a way to manage air quality issues in Alberta. It is a multi-stakeholder partnership, composed of representatives selected by industry, government and non-government organizations.

CASA is responsible for strategic planning related to province-wide air quality issues in Alberta. To guide this process, CASA has endorsed a Comprehensive Air Quality Management System (CAMS) for the province. CAMS promotes the locally-driven establishment of airshed zones to address local air quality issues, when and where appropriate.

[1] Alberta Environment, http://www3.gov.ab.ca/env/air/Info/aboutaq.html

Airsheds

Airshed zones are guided by local or regional multi-stakeholder non-profit societies who use the CASA consensus model to make decisions. These societies work within a designated area to monitor, analyze, and report on air quality and to recommend and implement actions to improve air quality within that zone. Stakeholders involved in airshed zone management may also develop a response plan to deal with air quality concerns in their region. Airshed zones typically implement air quality monitoring programs within their designated area and supply data to the CASA data warehouse.

There are seven airshed zones now operating in Alberta. Thus far, two airshed zones are operating in the SAL region – the Parkland Airshed Management Zone and the Palliser Airshed Society. A new zone is being formed in the Calgary-Bow Valley region, called the Calgary Regional Airshed Zone (CRAZ) (See Figure 14).[2]

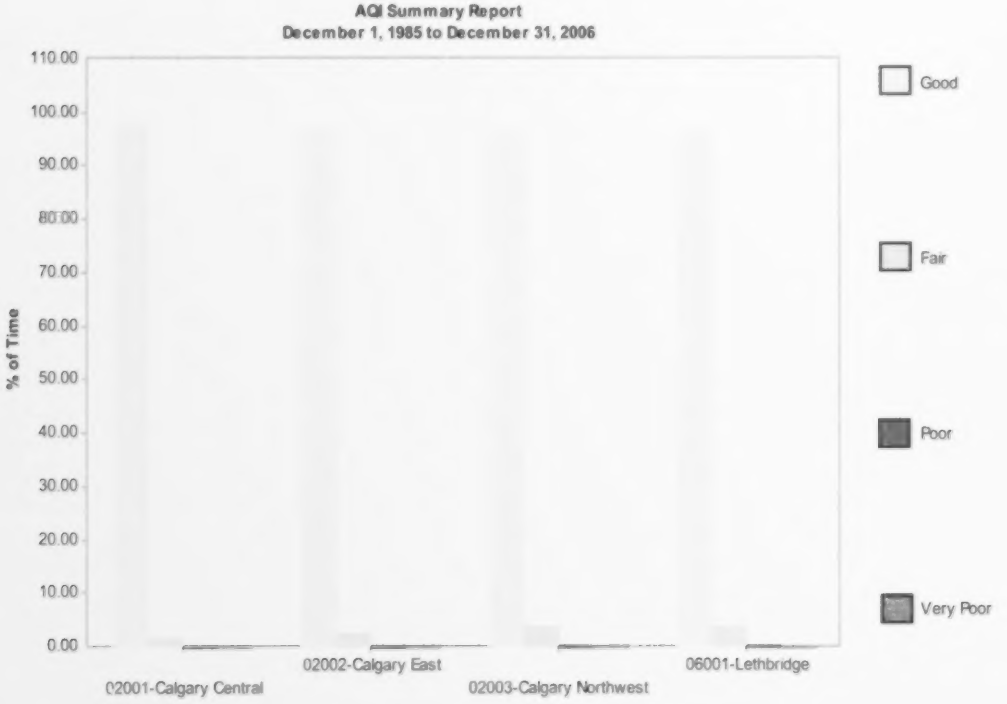


Figure 9. Long Term Trends in Air Quality

[2] Clean Air Strategic Alliance, http://www.casahome.org/airshed_zones/index.asp, http://casadata.org/zones/index.asp, http://www.palliserairshed.ca/

Figure 10 Average Annual Concentrations for Carbon Monoxide

Figure 11 Average Annual Concentrations for Ozone

Figure 12 Average Annual Concentrations for Sulphur Dioxide

Figure 13 Average Annual Concentrations for Hydrogen Sulphide

Figure 14 Alberta's Airshed Zones – 2006

Airsheds

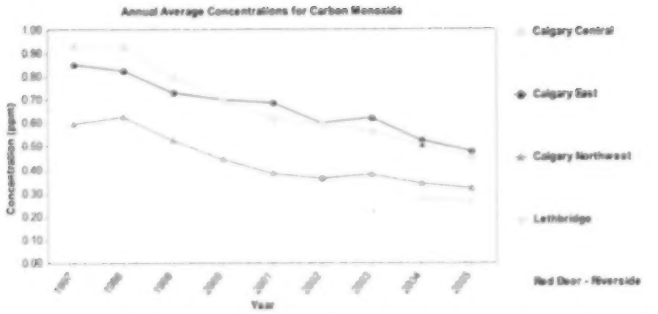


Figure 10. Average Annual Concentrations for Carbon Monoxide

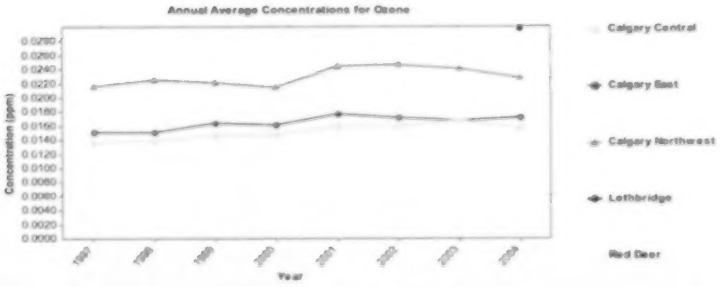


Figure 11. Average Annual Concentrations for Ozone

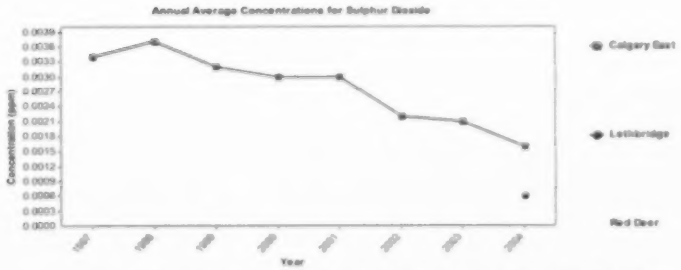


Figure 12. Average Annual Concentrations for Sulphur Dioxide

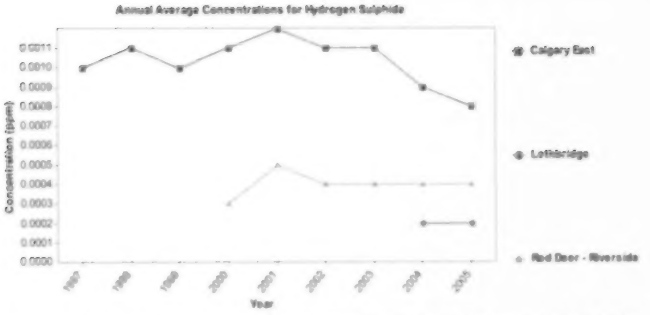


Figure 13. Average Annual Concentrations for Hydrogen Sulphide

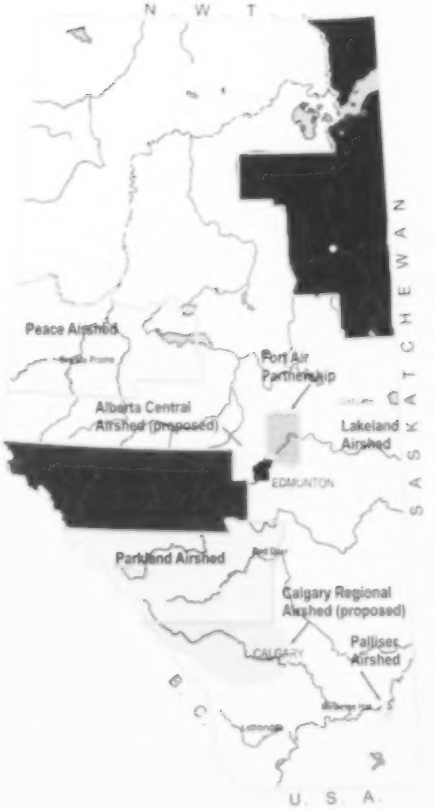


Figure 14. Alberta's Airshed Zones - 2006

Biodiversity and Species at Risk

Biodiversity refers to the variety of species and ecosystems and the ecological processes of which they are a part. Human economies are tied to the sustainable development of biodiverse resources. Shifts in biodiversity, caused by natural processes like fire and flooding, or by human activities, can alter the resource base of regional economies. In December 1992, with the support of the provinces and territories, the government of Canada ratified the United Nations Convention on Biological Diversity (also known as the Rio Convention). As required by the Convention, Canada developed the Canadian Biodiversity Strategy (CBS) to guide the conservation of Canada's biodiversity and the sustainable use of biological resources. The Alberta government participated in the development of the CBS and signed a Statement of Commitment supporting the strategy in November 1995.

In order to develop sound biodiversity conservation and sustainable use strategies, the CBS stresses the need to understand the current status of species and their populations, as well as population trends, and the causes of population and species change. The strategy recognizes existing constitutional and legislative responsibilities for biodiversity and incorporates the five major goals of the CBS:

1. To conserve biodiversity and use biological resources in a sustainable manner. Government of Alberta initiatives under this goal include the Special Places poli cy, the Alberta Forest Conservation Strategy, the Prairie Conservation Action Plan, the Fish Conservation Strategy, the Clean Air Strategic Alliance, the Sustainable Communities Initiative, and a variety of species management plans for threatened or endangered species.

2. To improve our understanding of ecosystems and increase our resource management capability. Initiatives under this goal include research through the Foothills Model Forest, monitoring and inventory programs which contribute to databases such as the Alberta Natural Heritage Information Centres and the Biological Species/Observation Database, Status of Wildlife reports, and a variety of integrated resource management processes.

3. To promote an understanding of the need to conserve biodiversity and use biological resources in a sustainable manner. Government of Alberta initiatives under this goal include annual State of the Environment reports, Fact Sheets and educational programs and activities for teachers, students, ranchers, farmers and land managers.

4. To maintain or develop incentives and legislation which support the conservation of biodiversity and the sustainable use of biological resources. Legislative frameworks that support this goal include the enhanced Wildlife Act, the Water for Life strategy, the Landuse Framework currently being developed, protected areas legislation, and the creation of legislation to allow for conservation easements.

5. To work with other countries to conserve biodiversity, use biological resources in a sustainable manner and share equitably the benefits that arise from the utilization of genetic resources. Government of Alberta initiatives under this goal include partnership in the North American Waterfowl Management Plan, the protection of four internationally important wetlands, and the Crown of the Continent partnership between Alberta, Montana and British Columbia.[1]

The need for a comprehensive, provincial biodiversity monitoring program has resulted in the development of the Alberta Biodiversity Monitoring Program (ABMP). The program involves government, research institutions, academia and industry and is a three phase project: technical design (1998 – 2002), testing and refinement (2002 – 2006) and implementation (2007 – ongoing).

A prototype project will run until Spring of 2007, when full implementation of the ABMP will take place. The objectives of the Prototype Project are to:

- Conduct field work;
- Develop remote sensing protocols for the ABMP;
- Develop cost effective aquatic protocols;
- Finalize all protocols to acceptable cost effective standards;
- Develop a basic data management system and populate it with field data;
- Develop biodiversity indices;
- Develop a range of products and services the program will deliver, and;
- Develop the business plan, governance structure and long-term funding model.

[1] Sustaining Alberta's Biodiversity: An Overview of Government of Alberta Initiatives Supporting the Canadian Biodiversity Strategy. Alberta Environment. 1997.

Biodiversity and Species at Risk

Few places in the world have as great a diversity of wildlife as Alberta. The province boasts:

10 **species of amphibians**	95 **species of mammals**
402 **species of birds**	8 **species of reptiles**
3500 **species of plants and fungi**	63 **species of fish**

Watercourses and adjacent riparian areas occupy only 2% of Alberta's surface area, yet are home to 80% of the province's wildlife species. However, the region's population growth and thriving resource-based economy are putting pressure on the sustainability of its natural capital.

HISTORICAL OVERVIEW

The biological diversity and sheer numbers of animals in southern Alberta during pre-settlement times is legendary. Massive herds of bison roamed the land and populations of grizzly bear and wolf were extensive. The western prairies of North America are estimated to have supported between 30 and 60 million bison, based on a carrying capacity of nine bison per km.[2]

First Nations people have been a prominent part of the southern Alberta landscape for thousands of years. Their traditional way of life relied upon the natural resources available to them in the form of plants and animals. Natural factors of climate, grazing and fire were major components in shaping the landscape.

These rich biological assets, as well as other resources, prompted European exploration in the 1700s. Large grazing leases were issued in the late 1800s, and partly as a result, bison were extirpated by 1880.

Important dates related to biodiversity since Alberta became a province in 1905 include:

1905: Hunting was regulated.

1930: The Natural Resources Transfer Act transferred ownership and management responsibility of most resources to the province.

early 1960s: Alberta Fish and Wildlife was created. The first biologists were hired, with an early emphasis on enforcement.

1970s - 1980s: Land use issues prompted an emphasis on habitat protection.

1989: The first Prairie Conservation Action Plan is developed by the World Wildlife Fund, in cooperation with the prairie provinces.

1990s: Alberta Environment developed an overview of Government of Alberta initiatives supporting the Canadian Biodiversity Strategy.

1995: Alberta's Special Places program, an initiative to complete a network of protected areas to preserve the province's environmental diversity, was begun with the designation of 29 new protected areas.

2003: Alberta Sustainable Resource Development launched the creation of a provincial biodiversity strategy.

2006: The third Alberta Prairie Conservation Action Plan was launched by the Prairie Conservation Forum, with a vision to conserve the biological diversity of native prairie and parkland ecosystems in Alberta, for the benefit of current and future generations.

[2] How Many Bison Originally Populated Western Rangelands? James H. Shaw, http://www.bisoncentre.com/resources/bce170/bce170_how_many_bison.html

Figure 15: Sites Designated Under Special Places Program

SPECIAL PLACES IN THE SAL REGION

Through Alberta's Special Places program, concluded in July 2001, a total of 20 sites added almost 300,000 hectares to the SAL region's protected areas land base (see www3.gov.ab.ca/env/parks/sp_places/ for more information).

Special Places Sites in SAL by Natural Region

# on Map	Name of Site	Designation Date	Natural Region	Area (ha)
25	Tolman Badlands HR	Oct 4/00	Parkland	3,700
F	Dry Island Buffalo Jump Expansion PP	Oct 4/00	Parkland	419
29	Ramsey NA	Aug 21/96	Parkland	492
31	Prairie Conifers NA	Jun 27/97	Grassland	1,788
30	Rosy Lake NA	Aug 21/96	Grassland	1,943
C	Head-Smashed-In Expansion PHR	Nov 21/98	Grassland	728
53	Twin River HR	Nov 15/99	Grassland	19,027
29	Ramsey NA	Aug 21/96	Parkland	14,430
25	Tolman Badlands HR	Oct 4/00	Grassland	2,200
75	Chinook HR	Dec 20/00	Grassland	11,165
28	Elbow Sheep WP	Jun 1/98	Rocky Mountain	79,998
43	Kananaskis NA	May 7/97	Rocky Mountain	1,582
40	Castle Special Management Area FLUZ	May 18/98	Rocky Mountain	104,103
41	West Castle Wetlands ER	Aug 26/98	Rocky Mountain	94
44	Bow Valley WP	Dec 9/98	Rocky Mountain	24,576
45	Bow Fern NA	Dec 9/98	Rocky Mountain	1,347
46	Canmore Nordic Centre PP	Dec 9/98	Rocky Mountain	435
51	Bob Creek WP	May 11/99	Rocky Mountain	21,291
52	Black Creek HR	May 11/99	Rocky Mountain	7,350
D	Bow Valley Expansion PP	May 18/99	Rocky Mountain	1,925

HR = Heritage Rangelands
PP = Provincial Park
NA = Natural Area
PHR = Provincial Heritage
WP = Wilderness Park
ER = Ecological Reserve

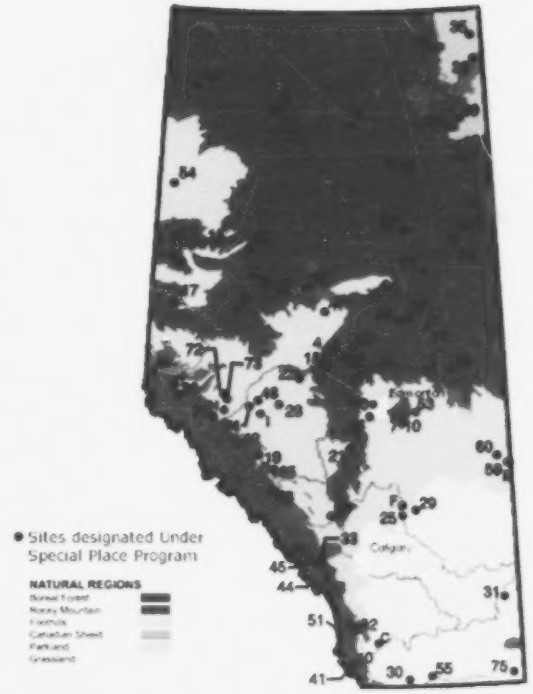


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Table 2. Special Places Sites in SAL by Natural Region

# on Map	Name of Site	Designation Date	Natural Region	Area (ha)
Parkland Natural Region				
25	Tolman Badlands HR	Oct 4/00	Parkland	3,700
F	Dry Island Buffalo Jump Expansion PP	Oct 4/00	Parkland	419
29	Rumsey NA	Aug 21/96	Parkland	492
Grassland Natural Region				
31	Prairie Coulees NA	Jan 27/97	Grassland	1,788
30	Ross Lake NA	Aug 21/96	Grassland	1,943
C	Head-Smashed-In Expansion PHR	Nov 21/98	Grassland	728
55	Twin River HR	Nov 15/99	Grassland	19,027
29	Rumsey NA	Aug 21/96	Parkland	14,430
25	Tolman Badlands HR	Oct 4/00	Grassland	2,200
75	Onefour HR	Dec 20/00	Grassland	11,165
Rocky Mountain Natural Region				
28	Elbow-Sheep WP	Jan 1/96	Rocky Mountain	79,998
33	Yamnuska NA	May 7/97	Rocky Mountain	1,582
40	Castle Special Management Area FLUZ	Mar 18/98	Rocky Mountain	104,103
41	West Castle Wetlands ER	Aug 26/98	Rocky Mountain	94
44	Bow Valley WP	Dec 9/98	Rocky Mountain	24,576
45	Bow Flats NA	Dec 9/98	Rocky Mountain	1,347
46	Canmore Nordic Centre PP	Dec 9/98	Rocky Mountain	435
51	Bob Creek WP	May 11/99	Rocky Mountain	21,291
52	Black Creek HR	May 11/99	Rocky Mountain	7,350
D	Bow Valley Expansion PP	May 18/99	Rocky Mountain	1,925

HR = Heritage Rangelands
PP = Provincial Park
NA = Natural Area
PHR = Provincial Heritage
WP = Wilderness Park
ER=Ecological Reserve

Biodiversity and Species at Risk

SPECIES AT RISK IN THE SAL REGION

The Canadian Species at Risk Act defines species at risk to be those being extirpated, endangered, threatened, or of special concern.[3]

Though species status differs across the province at the regional level, 61% of native prairie in Alberta's Grassland Natural Region has been lost. Grasslands are considered one of the most threatened natural regions on earth and represent Alberta's endangered species hotspot.

Economists are increasingly recognizing biodiversity as a form of "natural capital" in the sense that it is a stock of resources that produces a supply of goods and benefits. Production from biodiversity takes the form of conventional economic components such as timber and tourism, as well as ecosystem services such as soil fertility, water quality and carbon dioxide sequestration.[4]

From an aesthetic perspective, there are also high public expectations for conservation.

The status of most species in the SAL region is healthy, although there are growing numbers at risk. More than 75% of Alberta's species at risk are in the southeast part of the region.

Reasons for species loss include:

- The land base to support wildlife is diminishing; more than 80% of parklands/grasslands has been lost to fragmentation.
- A high percentage of land is under private ownership, making it more difficult to manage wildlife.
- Habitat for the native grassland vertebrate community is currently at 50% of the pre-settlement area, and slowly declining.
- Habitat for birds that flourish in areas of human activity (the anthropogenic bird community) is currently at 300% of pre-settlement area, and slowly increasing.
- The quantity and quality of habitat of individual species has declined by 80 – 95%.
- Wildlife diseases, often introduced by alien species, can destroy or debilitate significant populations of native wildlife.
- Wildlife-human conflicts are increasing with population growth and land fragmentation.

The species at risk, their habitats and the threats to their survival are described here. Virtually all of the threats to species in the SAL region are the result of anthropogenic activity.

Figures 16 – 19 show how native populations of birds such as Sprague's Pipit, Loggerhead Shrike and Sharp-tailed Grouse are declining as a result of human activity, while the American Robin, which thrives in areas of human settlement, is on the increase.

[3] Environment Canada www.pnr-rpn.ec.gc.ca/nature/endspecies/sar/db08s01.en.html

[4] Maintaining Alberta's Natural Advantage: Proposal for a Provincial Biodiversity Strategy. ASRD. December 15, 2003. Unpublished.

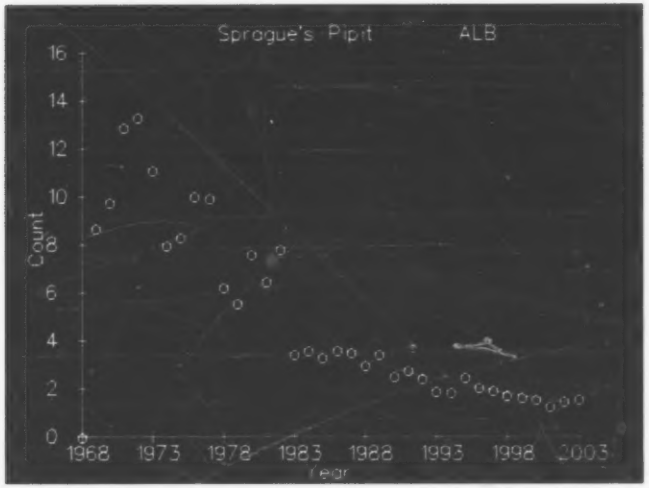


Figure 16. Response to Human Activity – Sprague's Pipit

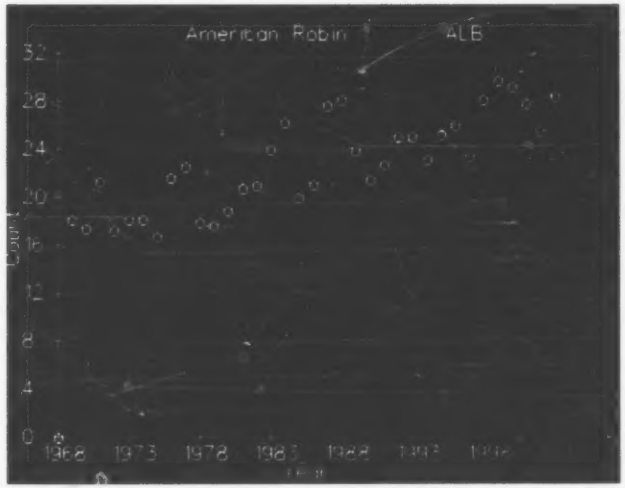


Figure 17. Response to Human Activity – American Robin

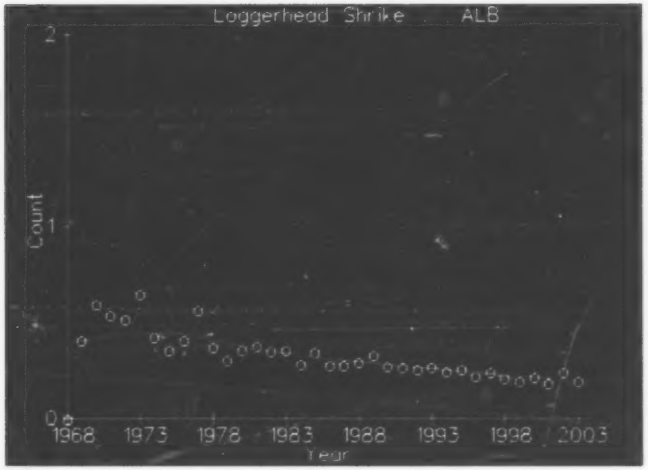
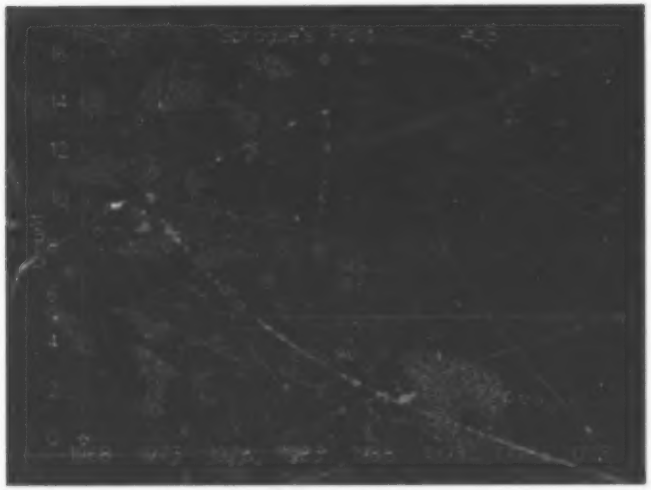


Figure 18. Response to Human Activity – Loggerhead Shrike

Figure 19. Response to Human Activity – Sharp-tailed Grouse



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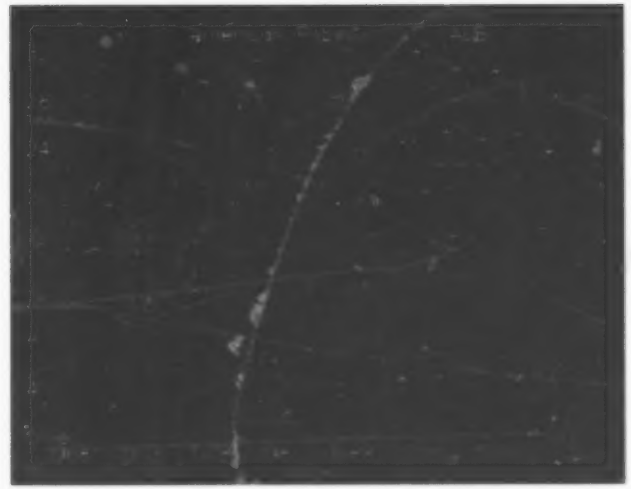


Figure 17. Response to Human Activity – American Robin

Figure 18. Response to Human Activity – Loggerhead Shrike

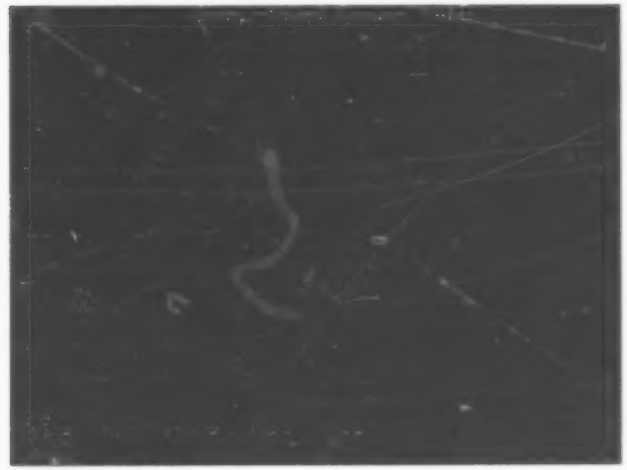


Figure 19. Response to Human Activity – Sharp-tailed Grouse

Biodiversity and Species at Risk

Table 3. SAL Region Species at Risk

BIRDS

Species	Description	Habitat	Threats
Burrowing Owl	• Occurs mostly in a belt from Regina, Saskatchewan to Lethbridge, Alberta. • Limited by the extent of grasslands. • 1990s decline: 22% per year. • Now fewer than 1000 pairs on the Canadian prairies. 	• Treeless plains, largely free of visual obstructions, such as grasslands grazed by livestock. • Uses burrows abandoned by ground-dwelling mammals (e.g., badgers, ground squirrels and prairie dogs) for nesting, roosting and caching food. • Short or sparse vegetation and permanent cover are preferred around the burrows. Grasslands with thicker vegetation support the small mammals they eat. • Sometimes found on roadsides and croplands and in urban areas where mowing keeps expanses of grass short.	• Cultivation of pastures, extermination of ground squirrels, and other agricultural activities reduce the number of suitable burrows. • The use of chemical pesticides to control grasshoppers and other insects reduces an important food supply. Other factors include inclement weather, illegal shooting, and collisions with motor vehicles. • During migration they have difficulty finding burrows since 99% of prairie dog colonies have been destroyed on the Great Plains. In winter, most of their habitat is cultivated and burrows may be in short supply.
Ferruginous Hawk	• Breeds from the southern Canadian Prairies and eastern Washington, south to Nevada, New Mexico, and northwest Texas. • The species occupies less than half its historic Canadian range. It now breeds exclusively in the grassland region of southern Alberta, southern Saskatchewan and southwest Manitoba.	• The Ferruginous Hawk occupies open, arid habitats dominated by grasses or sagebrush. • It requires an elevated nest site (isolated tree or bush), surrounding grassland over which to hunt, and an adequate supply of ground squirrel prey. It is not found where trees are abundant or land is extensively broken for cultivation.	• The major factor is the loss of grassland habitat, due to extensive agriculture and natural fire suppression, especially in grasslands ploughed for grain production. Cultivation reduces the number of prey species available, hence the number of hawks. Fire suppression has caused invasion of grasslands by trees growing from the north, pushing the hawk's range southward. • Mortality in ground nests is probably extremely high.

Biodiversity and Species at Risk

Species	Description	Habitat	Threats
Greater Sage Grouse	• Range covers 4000 km^2 in southeast Alberta. • There may have been 10 million in North America at the time of European exploration. • By 1970 there were 1.5 million and numbers continue to decrease.	• Found where sagebrush grows, i.e., the dry mixedgrass ecoregion, where it is warm and dry. • Nest in sagebrush habitat, most successfully where both lateral and vertical cover are present, and near running water.	• Heavy grazing, especially over the long term. • Oil and gas development. • Collisions with fences, power poles and farm vehicles. • Increasing coyote populations in the early 1990s.
Loggerhead Shrike	• A masked, hook-billed songbird known for its habit of impaling prey on thorns or barbed wire. • Most loggerhead shrikes arrive in southern Alberta during the first week of May and begin their return journey south by the end of August. • The loggerhead shrike has declined over much of its range. Between 1970 and 1991, this species has shown the most significant downward trend of any songbird in the southern Prairie Provinces.	• Inhabit open areas with scattered shrubby growth. They are found in open country, savannah, desert scrub, and open woodland. • Loggerhead shrikes are visual hunters and require tall perches from which to survey the surrounding countryside for potential prey.	• Pesticides: As a predator at the top of the food chain, shrikes accumulate chemicals in their tissues. Pesticides may be responsible for slowing the development of young shrikes, for reducing eggshell thickness, and for reducing the size of clutches and broods. • New agriculture practices, including the removal of hedgerows, shrubs and trees and the draining of potholes and sloughs, shrink habitat. • Road mortalities are a major cause of death, especially for juveniles, as these birds often nest and forage close to roads. The young are also susceptible to heavy rainfall and cold temperatures.
Peregrine Falcon	• Fastest of all raptors; can dive at speeds up to 300 km/hr. • Currently, there are fewer than 60 breeding pairs in Alberta.	• Usually nest on cliff ledges and hunt birds, often near wetlands.	• Once almost extinct in the Prairies, their numbers are now steadily increasing. A ban on the pesticide DDT, which caused their eggshells to become thin and break, was critical in recovering populations.

Biodiversity and Species at Risk

Species	Description	Habitat	Threats
Piping Plover	• Breeds in central and southern Alberta. • A 1986 survey found fewer than 300 piping plovers in Alberta, mostly near Provost, Hanna and Medicine Hat.	• Nests just above the normal high-water mark on exposed sand or gravel beaches. On the prairies, nesting occurs on gravel shores of shallow, saline lakes and on sandy shores of larger prairie lakes. • Piping plovers scrape out small, shallow nests in bare areas of sand, small pebbles or gravel. They prefer shorelines of prairie lakes and sloughs with heavy concentrations of mineral salts. • Seeps provide important foraging habitat.	• Loss of habitat, mostly caused by human use of beaches and disturbance around nesting sites. • Domestic pets prey on the eggs and young, as do wildlife such as gulls and raccoons that are initially attracted to the nesting areas because of garbage left by picnickers. • Livestock trample nests. • Changes in water levels caused by recreational or building activities, dams and seasonal storms harm nesting birds.
Sage Thrasher	• Distinguished from brown thrashers by their shorter tail and greyish rather than reddish-brown colour. • Prefer areas where sagebrush grows.	• Almost entirely dependent on sagebrush habitat during the breeding season. • Shrub size is very important for nesting, as the birds require sagebrush approximately one meter high. • In the winter, the sage thrasher uses a variety of scrub, brush, and denser habitats.	• Areas with suitable sage thrasher habitat in Canada have been slowly decreasing during the last 50 years.
Sprague's Pipit	• A small, ground-nesting songbird that is commonly found in suitable habitat, particularly on the Canadian prairies. • Breeding Bird Survey data collected during the past 30 years show that populations are declining rapidly. • Since 1996, populations in Alberta have declined by 9.4% per year.	• Native grassland. Rarely found in cultivated lands, or in areas where native grasses have been replaced with introduced forages. • Prefer native vegetation of intermediate height and density, with moderate amounts of vegetative litter, lightly to moderately grazed, or where fires periodically remove vegetation.	• Habitat loss is the primary cause of decline. Cultivation makes habitat unsuitable. • Other factors include intensive grazing, which removes vegetation and may cause reproductive failure due to disturbance and trampling of nests; haying; fragmentation of habitat; and reduction in fire frequency, which encourages encroachment of woody vegetation and promotes excessive growth of vegetation and accumulation of litter. • The use of pesticides to control grasshoppers. • Drought affects nesting and food supply.

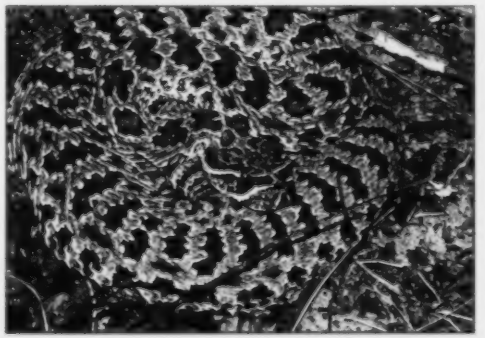
Biodiversity and Species at Risk

MAMMALS

Species	Description	Habitat	Threats
Grizzly Bear	• Grizzly bears need a great deal of space to provide for their habitat needs. • The home range of grizzly bears on the eastern slopes of the Central Rockies Ecosystem is quite large, from about 500 km^2 for females to 1000 km^2 for males. • Home range size in this region indicates that food sources are widely dispersed throughout the landscape, rather than concentrated in local areas.	• The habitat associations of the grizzly are strongly seasonal; the consumption of a wide variety of plants is important for many Grizzly Bears so their movements often reflect the development of the local plant community. • In mountainous areas, vegetation emerges earlier at lower elevations; bears therefore descend from their denning sites to feed in the spring, and return later in the season to higher elevations.	• Most bears die as a result of human activities. • Annual harvest from recreational hunting in Alberta since 1988 has ranged from five to 20 bears, averaging 14.15 grizzlies per year. Most grizzlies taken in Alberta are males, ensuring the harvest will have little effect on the population growth rate. • Activities undertaken by humans, including mining, forestry, agriculture, residential development, and recreation, degrade the quality of the habitat for bears, and increase their risk of mortality. • Roads, railroads, power lines, and other linear features are a particular threat to habitat, feeding and migration.
Swift Fox	• Once found in dry prairie habitat from the southern Canadian prairie to Texas, the species began to decline early this century. • The last Canadian specimen was captured in Govenlock, Saskatchewan in 1928. • The Swift Fox has made a comeback in much of its U.S. range and is being reintroduced in Canada.	• Swift Foxes prefer open, sparsely vegetated short-grass and mixed-grass prairie, where visibility and mobility are unimpeded. Native vegetation common in such grasslands includes buffalo grass, bluestem, and wire grass. • Suitable den habitat, such as well-drained slopes and hilltops near permanent water bodies, is required.	• The conversion of native prairie grasslands to farmland has reduced both the quantity and quality of habitat. • The Swift Fox is very vulnerable to shooting and trapping since it is not wary of humans. The use of poison to kill coyotes has been detrimental to the Swift Fox. Predation by coyotes, eagles, and red-tailed and rough-legged hawks is a potential threat. • The Swift Fox is being reintroduced in certain parts of the SAL area.

Biodiversity and Species at Risk

REPTILES AND AMPHIBIANS

Species	Description	Habitat	Threats
Northern Leopard Frog	• By 1979, the species had vanished from most of its range in Alberta. • Data from the 1990s show that only 26 of 74 known breeding populations remain, with breeding confirmed in only 12 of these. The majority of these 12 are in the southeast corner of Alberta.	• The Northern Leopard Frog uses a variety of habitats to meet its needs throughout the year. Separate sites are generally used for over-wintering and breeding. • Overwintering sites are well-oxygenated water bodies, such as streams or larger ponds that do not freeze solid. Breeding sites are temporary ponds that often dry up in late summer.	• Destruction or modification of the species' breeding, summer, or overwintering habitat, can eliminate a local population. • Introduction of animals or plants, such as Common Carp or Purple Loosestrife, can make habitat unsuitable for Northern Leopard Frogs.
Prairie Rattlesnake	• The Prairie Rattlesnake reaches the northern limits of its range in southern Alberta. • This species is designated as "may be at risk" in Alberta due to an accumulation of anecdotal evidence suggesting prairie rattlesnake populations have declined in the province in recent years. • Historically, rattlesnakes in Alberta ranged from the United States-Canada border as far north as Trochu and from the Alberta-Saskatchewan border almost to Calgary.	• Rattlesnakes live and breed in hibernacula, which receive year-round protection under the Wildlife Act, prohibiting the destruction of these sites. • Prairie rattlesnakes occur within the Grassland Region of Alberta. Habitat in this region is mixed-grass prairie. 	• Industrial and agricultural activities. • Vehicle traffic on all types of roads kills rattlesnakes that are either crossing the roads, or sunning themselves on roads. • Cultivation: snakes are killed by machinery when the land is being worked and when crops are being harvested. • Pesticides may contaminate the food of rattlesnakes. • Many people kill, or otherwise harass rattlesnakes because they dislike them. • Weedy plants and species introduced for agriculture often become established in areas with disturbed soils. Over time, these weedy/agronomic species then invade the surrounding native grassland, thus reducing the quality of that grassland for rattlesnakes.

Biodiversity and Species at Risk

PLANTS

Species	Description	Habitat	Threats
Slender Mouse-ear Cress	• Has single or branched stems each ending with several white flowers. • Its flattened seed capsules contain many seeds.	• Grows in flat, open grasslands with sandy soil.	• Loss of habitat and grazing by animals are the main limiting factors
Small-flowered Sand Verbena	• In Alberta and Saskatchewan, the Small-flowered Sand Verbena is found in the mixed-grass prairie region.	• Occurs at multiple sites in southeast Alberta, in the general area of the confluence of the Bow, Oldman, and South Saskatchewan rivers. • Grows on sandhill areas in very dry conditions, and usually requires some drifting or unstable sand. • The largest populations occur on hard-packed, fine sand, on level ground, but it is also found on slopes or the ridge tops of the dunes.	• Dune stabilization has resulted in a significant loss of habitat. • The absence of fire and the decreased grazing of prairie areas have resulted in less drifting or unstable sand, allowing the establishment of other species, including alien invasive weeds, on the dunes. • The cultivation of areas surrounding existing populations of Small-flowered Sand Verbena also decrease opportunities for it to spread naturally.
Soapweed Yucca	• A large plant with a crown of broad, sword-like leaves. When flowering it has a tall stalk topped with creamy white flowers. • Soapweed can only be pollinated by the Yucca Moth and the moth larva eats only the seeds of Soapweed.	• Thrives in arid regions such as dry coulee slopes.	• Possible loss of habitat and consumption of flowers by herbivores (deer, antelope and cattle) limit populations. • The apparent disappearance of the Yucca Moth from one population and low moth numbers at the other threaten the long-term survival of the only two populations confirmed to have been naturally established in Canada.
Tiny Cryptanthe	• Has miniscule white flowers with a yellow "eye" in the centre and small leaves at the base of each sepal (tube-like structures below the flowers that have bristly hairs and thick, whitish veins).	• Usually grows in sandy native grassland within river valleys or nearby uplands.	• Destruction of Mixed Prairie Grassland habitat. • Urban development has probably caused the destruction of a historic site for the species at Medicine Hat, Alberta. • Changes to the regime of the South Saskatchewan River resulting in flooding or water diversion could imperil the species in Canada.

Biodiversity and Species at Risk

Species	Description	Habitat	Threats
Western Blue Flag	• Has blue-green leaves that are 30 to 60 cm long and 3 to 8 cm wide and pale blue or blue-violet flowers and grows from a thick, dark rhizome. • The size of the current total population in Alberta is unknown. In 1989, there were fewer than 10,000 plants in Canada. • No known populations have been extirpated in the last decade, but the habitat for two populations has been degraded.	• Restricted to about 500 km^2 in southern Alberta where it is known to occur at seven locations. • The Western Blue Flag inhabits moist meadows and stream banks, areas that are usually wet in the spring but dry or just slightly moist during the summer. • The plants require moisture when they are flowering, and warmer and drier conditions in subsequent months. All Alberta populations are on level or gently sloping ground that is only slightly humid during most of the growing season.	• Distribution is limited by climate, suitable habitat and its narrow environmental tolerances. • Loss of habitat (especially conversion of native grassland to pasture and cropland) is an important limiting factor. Because this species occupies a very narrow niche, human activities such as alteration of drainage patterns, overgrazing, cultivation, and the use of herbicides limit the areas where it can survive. Other limiting factors include competition from native and invasive species, change in habitat conditions, and the collection of plants for horticultural and medicinal uses.
Western Spiderwort	• Has slender grass-like stems that can easily be confused with grasses when it is not in flower. • The three-petalled flowers range in colour from rose to dark-blue and occasionally white. They are arranged in clusters, usually with one flower in each cluster blooming at a time.	• Adapted to growing in areas with low soil moisture. • Grows on partly stabilized sand dune ridges, usually on the crests, and on steeper south-facing slopes. • Typically associated with areas of active, drifting sand, where vegetation is relatively sparse.	• Destruction of Mixed Prairie Grassland habitat. • Urban development has probably caused the destruction of a historic site for the species at Medicine Hat, Alberta. • Changes to the regime of the South Saskatchewan River resulting in flooding or water diversion could imperil the species in Canada.

Biodiversity and Species at Risk

Canada Thistle

Crested Wheat Grass

INVASIVE PLANT SPECIES

The World Conservation Union has identified invasive alien species as the second most significant threat to biodiversity, after habitat loss. Anthropogenic activities on the landscape – including the deliberate introduction of alien plant species, forestry, road building and agriculture – often provide the vectors for invasive species to take hold. As with the introduction of animals and insects, invasive plants lack environmental controls over their growth and may crowd out less hardy but native plant species.

An invasive plant survey completed by Alberta's agricultural field staff in 2004 identified the top three most problematic species in each jurisdiction. Table 4 lists those invasive plants.[5]

[5] Alberta Invasive Plants Council, http://www.invasiveplants.ab.ca/alberta2004.htm

Biodiversity and Species at Risk

Table 4. Invasive Plants - three most problematic species

	BLUEWEED	CANADA THISTLE	CLEAVERS	COMMON TANSY	COMMON TOADFLAX	DALMATIAN TOADFLAX	DIFFUSE KNAPWEED	DOWNY BROME	FIELD SCABIOUS	HOUND'S TONGUE	LEAFY SPURGE	OXEYE DAISY	PERENNIAL SOWTHISTLE	PURPLE LOOSESTRIFE	RUSSIAN KNAPWEED	RUSSIAN OLIVE	SCENTLESS CHAMOMILE	SPOTTED KNAPWEED	STORK'S BILL	TALL BUTTERCUP	WHITE COCKLE	WILD CARAWAY
Counties																						
Camrose		*			*								*									
Cardston						*					*							*				
Clearwater									*											*		*
Cypress							*															
Forty Mile					*											*	*					
Kneehill					*														*		*	
Lacombe		*		*													*					
Lethbridge		*									*							*				
Mountain View		*			*															*		
Newell								*									*	*				
Paintearth					*												*				*	
Ponoka		*			*												*					
Red Deer				*	*												*					
Starland		*	*										*									
Stettler				*							*										*	
Vulcan		*			*								*									
Warner		*												*				*				
Wetaskiwin				*								*								*		
Wheatland		*			*												*					
Municipal Districts																						
Acadia																						
Bighorn					*				*			*										
Foothills																						
Pincher Creek											*	*								*		
Provost		*			*												*					
Ranchland	*									*		*										
Rocky View		*			*												*					
Taber		*									*				*							
Willow Creek						*					*							*				
Special Areas																						
Special Area 2											*						*	*				
Special Area 3					*						*				*							
Special Area 4	*										*								*			

As shown on the map in Figure 20, the administrative boundaries that define settlement in the SAL region consist of:

- 19 Counties
- 9 Municipal Districts
- 3 Special Areas
- 3 Improvement Districts

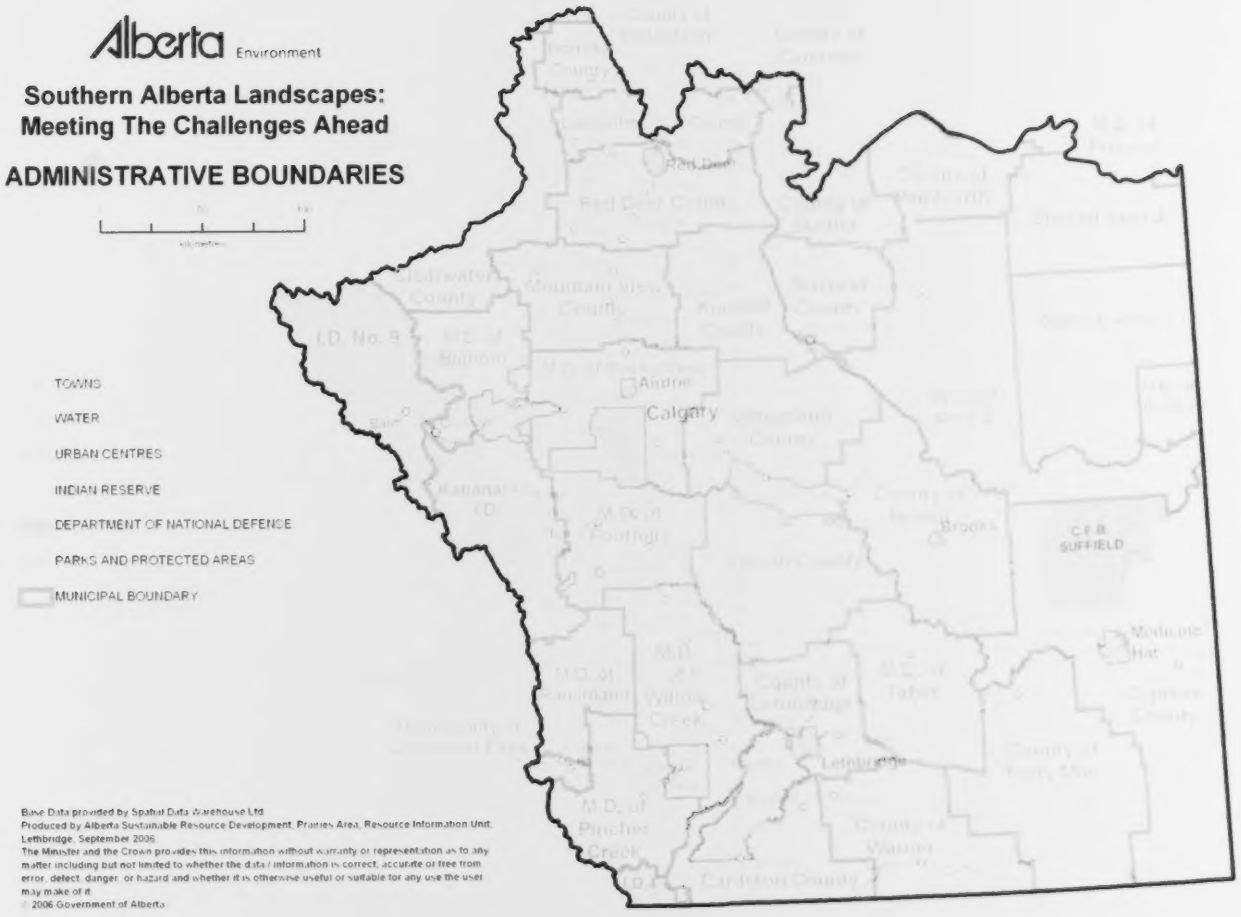

Alberta Environment
Southern Alberta Landscapes:
Meeting The Challenges Ahead
ADMINISTRATIVE BOUNDARIES
TOWNS
WATER
URBAN CENTRES
INDIAN RESERVE
DEPARTMENT OF NATIONAL DEFENCE
PARKS AND PROTECTED AREAS
MUNICIPAL BOUNDARY
Airdrie
Calgary
Brooks
C.F.B. SUFFIELD
Medicine Hat
Lethbridge
Base Data provided by Spatial Data Warehouse Ltd.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge, September 2006.
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Figure 20. Administrative Boundaries in the SAL Region

Administrative Boundaries

As shown on the map in Figure 20, the administrative boundaries that define settlement in the SAL region consist of:

- 19 Counties
- 9 Municipal Districts
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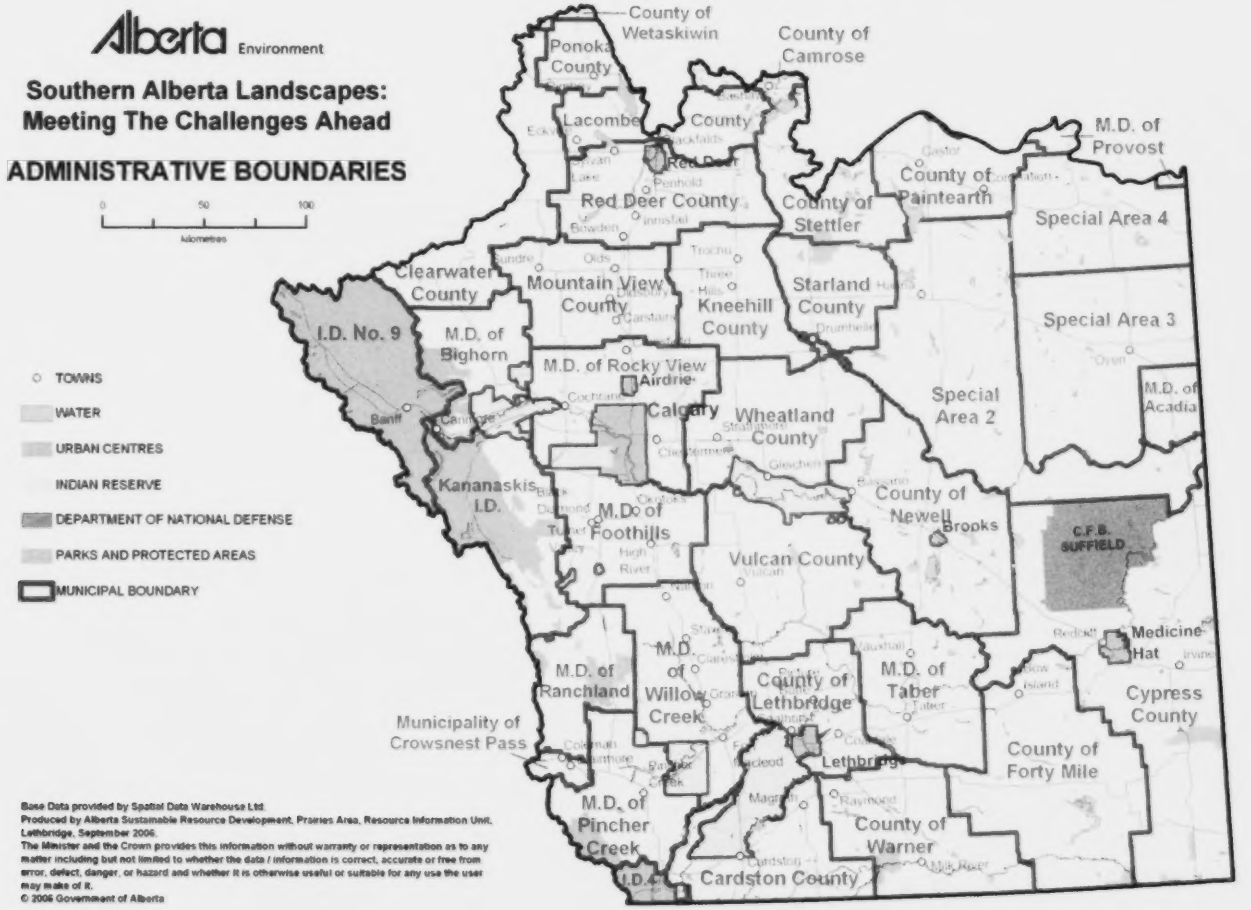

Figure 20. Administrative Boundaries in the SAL Region

Administrative Boundaries

LAND OWNERSHIP

Figure 21 shows the percentage of the total land area owned by each jurisdiction in the SAL region. The map in Figure 22 shows land ownership in the region.

Figure 21. Land Ownership in the SAL Region

INDIAN RESERVES

Indian Reserves in the SAL region were established through the treaty process in 1877 under Treaty Seven between the Crown, as represented by the Queen of England and the Siksika Nation, Piikani Nation, Kainai Nation, Tsuu T'ina Nation, and Stoney Nation, which includes Bearspaw, Chiniki and Wesley Nations (referred to as First Nations).

These lands are under federal jurisdiction. All activities that affect reserve lands, as well as those that may infringe on First Nations rights and traditional uses, require consultation with the relevant First Nation.

Table 5. Reserves in the SAL Region

	Population (2001)	Area (km²)
Stoney #142, 143, 144	2,155	402.26
Tsuu T'ina Nation #145	1,982	283.14
Siksika #146	2,767	696.56
Eden Valley #216	216	17.48
Piikani (Peigan) #147	1,537	430.31
Kainaiwa (Blood)	3,852	1,414.03
TOTAL	**12,509**	**3,243.78**

CENSUS DIVISIONS

There are 12 Census Divisions in the SAL region. A Census Division is a group of neighbouring municipalities joined together for the purposes of regional planning and for managing common services (such as police or ambulance services). These groupings are established under laws in effect in certain provinces and territories of Canada.[1]

[1] Statistics Canada, http://www12.statcan.ca/english/census01/Products/Reference/dict/geo008.htm

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LAND OWNERSHIP
TOWNS
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URBAN CENTRES
FEDERAL
FREEHOLD
PROVINCIAL
INDIAN RESERVE
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Lethbridge
Base Data provided by Spatial Data Warehouse Ltd.
Land Ownership Status obtained from Land Status Automated System, Alberta Energy, 2004
Notes
- Federal includes but is not limited to Department of National Defense land and National Parks.
- Freehold is land privately owned by an individual or company (not owned by the Crown).
- Provincial includes all crown land (land owned by the Provincial Government) which includes but is not limited to Provincial Parks, Wilderness Areas, Ecological Reserves, and Natural Areas.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge. September 2006.
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Figure 22: Land Ownership in the SAL Region

Administrative Boundaries

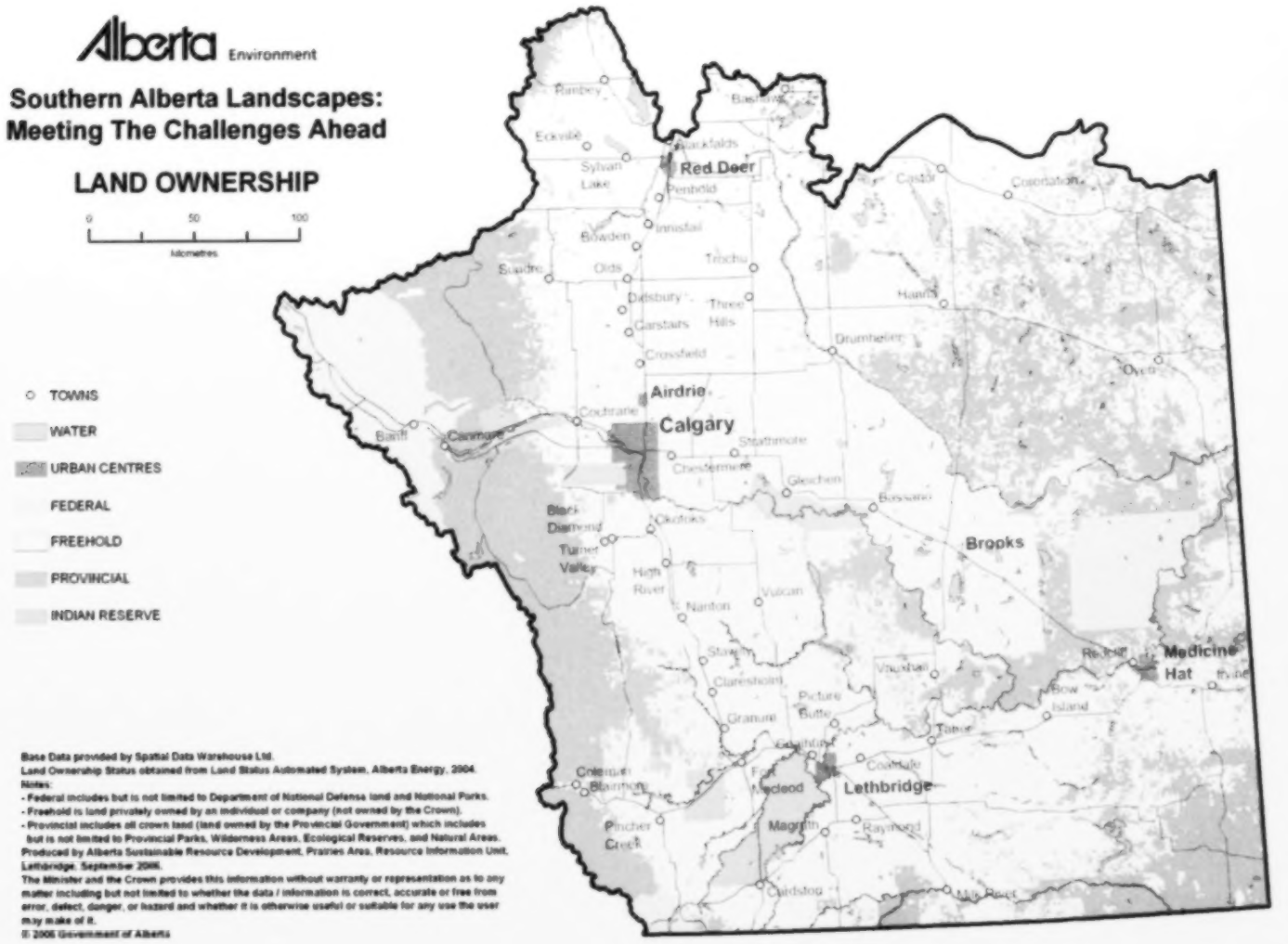


Figure 22: Land Ownership in the SAL Region

Administrative Boundaries

Table 6 lists the census divisions in the SAL region, including the municipal counties, improvement districts, special areas, specialized municipalities, municipal districts and regional municipalities in each. Figure 23 shows Census Divisions and urban centres with greater than 10% population increase between 1996-2001.

Table 6. Census Divisions in the SAL Region

Division No. 1
- Cypress County
- Forty Mile County No. 8

Division No. 2
- Lethbridge County
- Newell County No. 4
- Taber Municipal District
- Warner County No. 5

Division No. 3
- Willow Creek Municipal District
- Pincher Creek Municipal District
- Cardston County
- Improvement District No. 4

Division No. 4
- Acadia Municipal District No. 31
- Special Area No. 2
- Special Area No. 3
- Special Area No. 4

Division No. 5
- Drumheller County
- Kneehill County
- Starland County
- Vulcan County
- Wheatland County

Division No. 6
- Calgary
- Foothills Municipal District No. 31
- Mountain View County
- Rocky View Municipal District No. 44

Division No. 7
- Paintearth County No. 18
- Provost Municipal District No. 52
- Stettler County No. 6
- Wainwright Municipal District No. 61

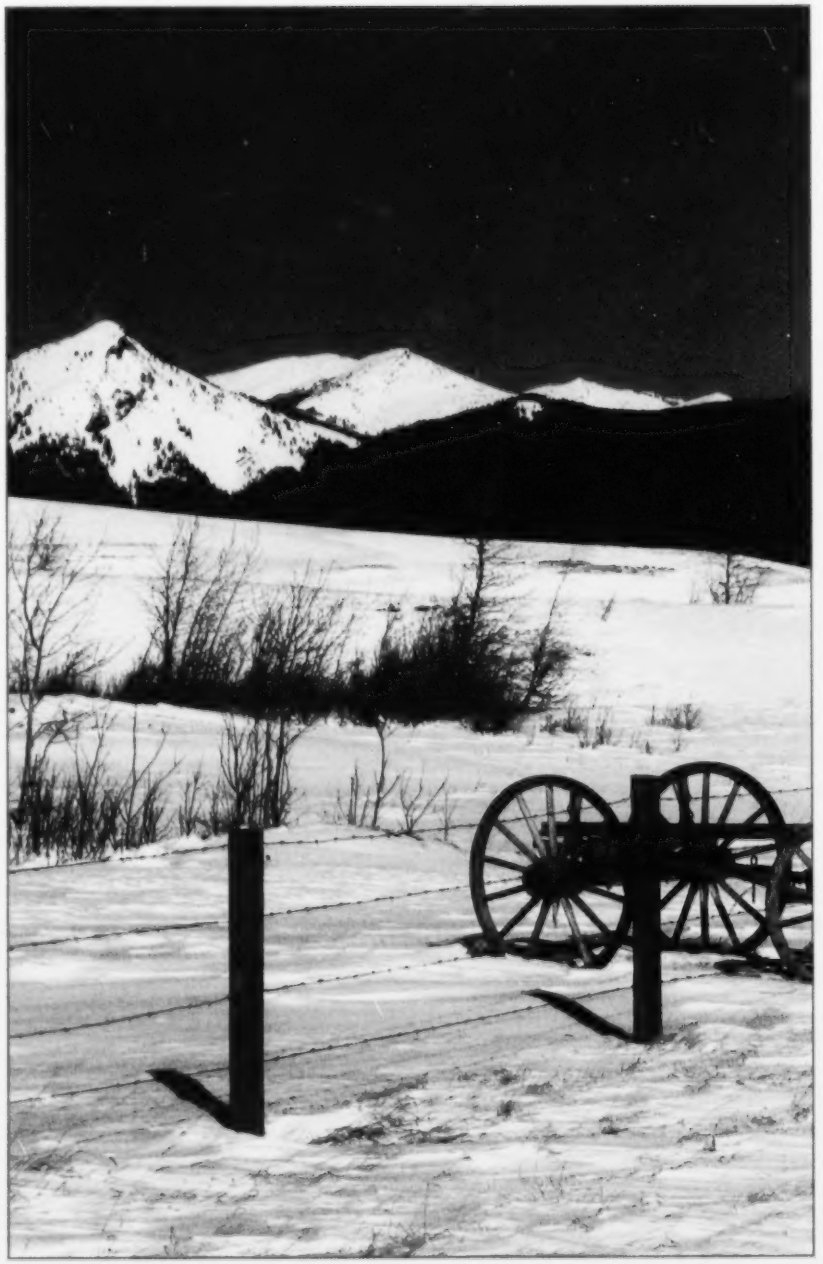
Division No. 8
- Lacombe County
- Ponoka County
- Red Deer County

Division No. 9
- Clearwater County

Division No. 10
- Camrose County No. 22

Division No. 11
- Wetaskiwin County No. 10

Division No. 15
- Bighorn Municipal District No. 8
- Canmore
- Crowsnest Pass
- Improvement District No. 9
- Kananaskis Improvement District No. 5
- Rangeland Municipal District No. 66



Administrative Boundaries

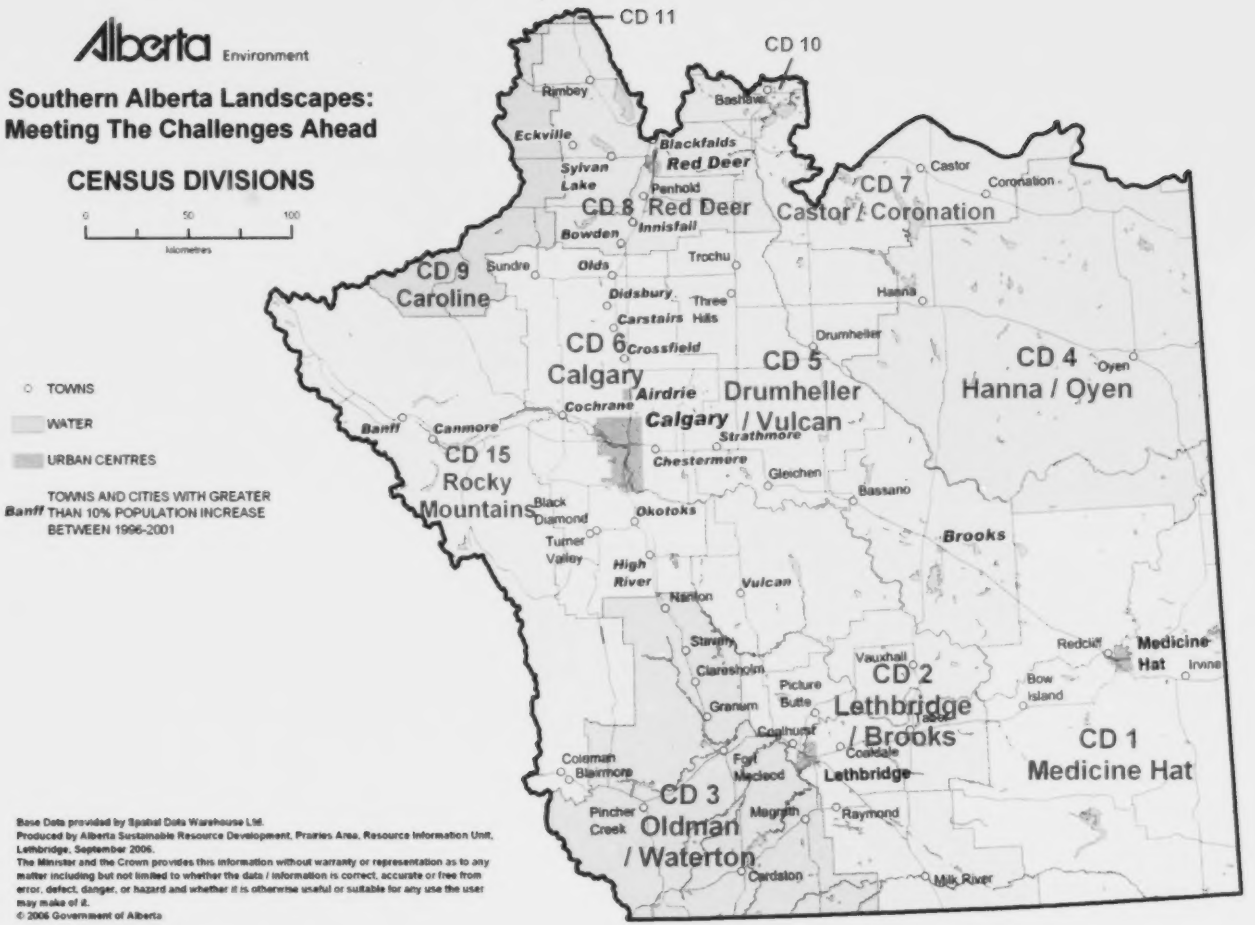


Figure 23. Census Divisions in the SAL Region

Population and Settlement

Historically, the SAL region was largely rural. It was only after 1950 that the trend from rural to urban began, as is shown in Figure 24. While rural population has remained relatively stable at about 200,000 people, urban population trends in Calgary and the Four Cities (Airdrie, Lethbridge, Medicine Hat, and Red Deer) show steady growth. The City of Calgary passed the one million mark in July 2006. Brooks, with a population of 11,604 in 2005, became a city effective September 1, 2005.

The total population in the SAL region in 2004 was 1,488,000. Of this, 5% (74,400) lived on farms, 11% (163,680) lived in rural residential areas, and 84% (1,249,920) lived in urban areas.

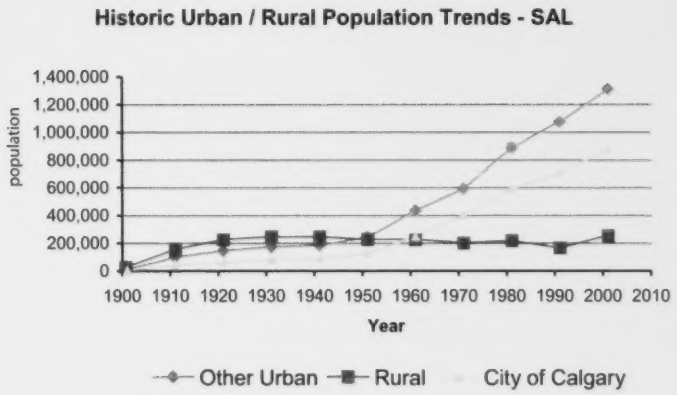


Figure 24. Historic Population Trends - SAL Region

POPULATION DENSITY BY CENSUS DIVISION[1]

There are 12 Census Divisions in the SAL Region (see Figure 25). Population density in the SAL Census Divisions (CDs) shows significant diversity, as illustrated in Table 7. The average for the region is approximately 13 people per km^2. The Calgary Census Division, with more than two-thirds of the region's population, has by far the highest density, at 80.8 persons per km^2. CD8 (Red Deer) follows with a density of 15.4 persons per km^2, reflecting both a fairly high level of urbanization and a more dense rural population.

The lowest population density, on a subregional basis, is 0.5 persons per km^2 for CD4 (Hanna/Oyen). This Census Division is characterized by sparsely populated agricultural areas and a few small urban centres. CD15 (Rocky Mountains), and CD9 (Caroline/Clearwater) have low population densities of 1.2 and 1.0 persons per km^2 respectively. Both these Census Divisions are characterized by large, sparsely populated, forested and agricultural areas, with few urban centres.

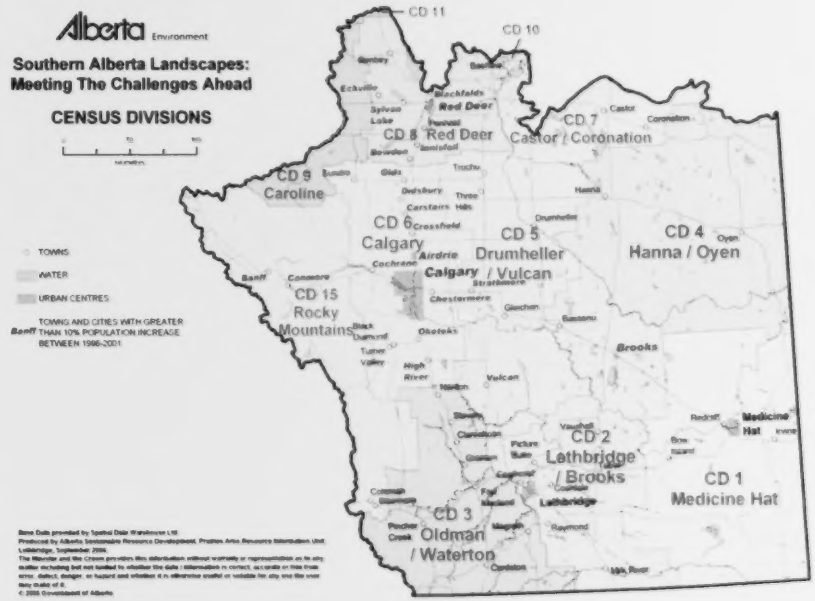


Figure 25. Census Divisions in the SAL Region

[1] Statistics Canada, http://www12.statcan.ca/english/census01/Products/Reference/dict/geo008.htm

URBAN POPULATION IN THE SAL REGION[2]

While urban growth since 1950 has been steadily increasing, growth in the Calgary/Edmonton corridor has been particularly rapid. Table 7 shows population for each Census Division. As Table 8 shows, Calgary, Airdrie, Lethbridge, Medicine Hat and Red Deer all experienced double digit growth between 1996 and 2005. Figure 26 shows the location of the major urban centres in the SAL Region.

Table 7. Population Density in SAL Region

Census Division#		Population, 2001	Land Area in km²	Population Density, Persons per km² 2001
6	Calgary	1,021,060	12,642	80.8
8	Red Deer*	153,049	9,908	15.4
2	Lethbridge/Brooks	133,913	17,655	7.6
1	Medicine Hat	67,402	20,516	3.3
5	Drumheller/Vulcan	47,606	16,775	2.8
3	Oldman/Waterton	37,580	13,866	2.7
7	Castor*	40,407	19,204	2.1
15	Rocky Mountains*	34,068	28,400	1.2
9	Caroline*	19,573	18,921	1.0
4	Hanna/Oyen	11,300	21,466	0.5

CDs 10 and 11 are not listed, as they contain a negligible portion of the regional population.
* Populations and land areas are for entire Census Divisions, although those CDs with an asterisk (*) are only partially within the SAL area.

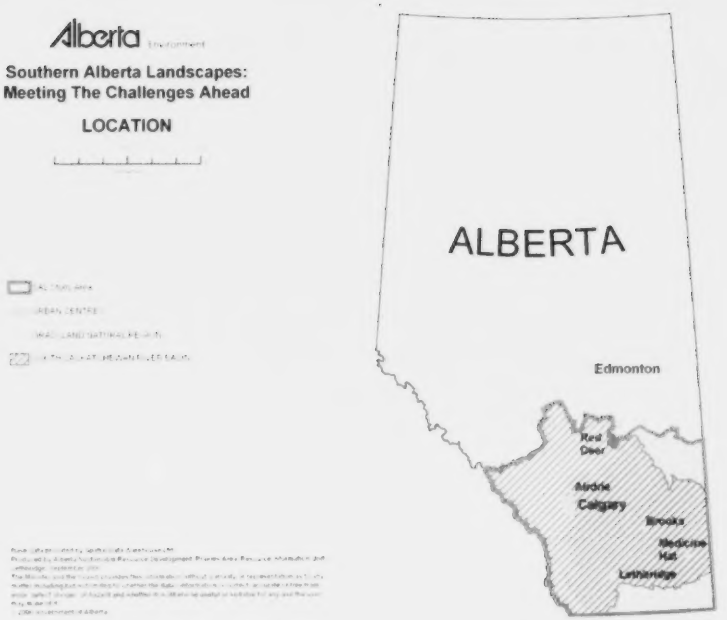


Figure 26. Location of major cities in the SAL region

Table 8. Population Growth of Major Urban Centres

City	Population in 2005	Population in 1996	Percent change	Land area km²
Calgary	956,078	768,082	+24.5	701.79
Airdrie	27,069	15,946	+69.8	21.48
Lethbridge	77,202	63,053	+22.4	121.83
Medicine Hat	56,048	46,783	+19.8	111.99
Red Deer	79,082	60,080	+31.6	60.90
Total	**1,195,479**	**953,944**	**+25.3**	**1,023.99**

[2] Statistics Canada, http://www12.statcan.ca/english/profil01/PlaceSearchForm1.cfm and Alberta Municipal Affairs, Municipal Services Branch Official Population List, http://www.municipalaffairs.gov.ab.ca/ms/pdf/2005pop.pdf

Population and Settlement

URBAN POPULATION IN THE SAL REGION[2]

While urban growth since 1950 has been steadily increasing, growth in the Calgary/Edmonton corridor has been particularly rapid. Table 7 shows population for each Census Division. As Table 8 shows, Calgary, Airdrie, Lethbridge, Medicine Hat and Red Deer all experienced double digit growth between 1996 and 2005. Figure 26 shows the location of the major urban centres in the SAL Region.

Table 7. Population Density in SAL Region

Census Division#		Population, 2001	Land Area in km²	Population Density, Persons per km² 2001
6	Calgary	1,021,060	12,642	80.8
8	Red Deer*	153,049	9,908	15.4
2	Lethbridge/Brooks	133,913	17,655	7.6
1	Medicine Hat	67,402	20,516	3.3
5	Drumheller/Vulcan	47,606	16,775	2.8
3	Oldman/Waterton	37,580	13,866	2.7
7	Castor*	40,407	19,204	2.1
15	Rocky Mountains*	34,068	28,400	1.2
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Population and Settlement

CITY OF CALGARY

Calgary is a growing city adjacent to the lower foothills of the Rocky Mountains. The city itself covers 702 km^2. Average precipitation is 43 cm/year, and the city and surrounding region support a variety of vegetation and habitat types.

With a population of more than 1 million people, Calgary is the fifth largest city in Canada. Average annual increases from 1997-2001 have been approximately 17,000 persons. This is due to a diverse economic base and resulting demand for a working population, coupled by high demands within the oil and gas sector.

LAND USE AND AVAILABILITY

According to the 2002 Parcel Land Base:[3]

- 25.07% of the land is in residential development
- 4.73% is in industrial development
- 2.39% is commercial, and
- 22.70% of the land is agricultural or unused space

The largest increase in land area has been for residential development, with a high rate of development in new communities and in "bedroom communities" outside the city. More than 30,000 people live outside Calgary, but work in the city. Figure 27 shows how the footprint of the major cities has grown from 1926 to 2000. In its use of resources, Calgary has more than five times the average global carrying capacity of 1.8 hectares per person. However, the city is ranked first of 215 cities worldwide in dealing with air pollution, waste disposal and sewage system efficiency.[4]

Land use in the city is mainly residential and commercial, with a relatively small industrial base concentrated mostly in the east sector of the city. There are 29 major parks in the city and there has been a steady increase in open space per capita from 1993. As of 2001, there were 85 km^2 of parks and open space. Developers are required by the city to have a set percentage of open park space in new subdivisions.

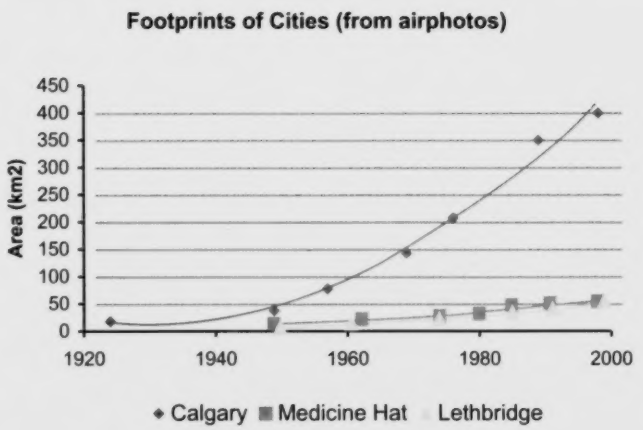


Figure 27. Human Footprint of Major Cities in SAL Region

[3] The City of Calgary State of the Environment Report 2002 (2nd Edition)
[4] The City of Calgary State of the Environment Report 2002 (2nd Edition)

THE FOUR CITIES: Airdrie, Lethbridge, Medicine Hat and Red Deer

Table 9 summarizes the land use and urban development characteristics of the Four Cities.

Table 9. Land Use and Urban Development in the Four Cities

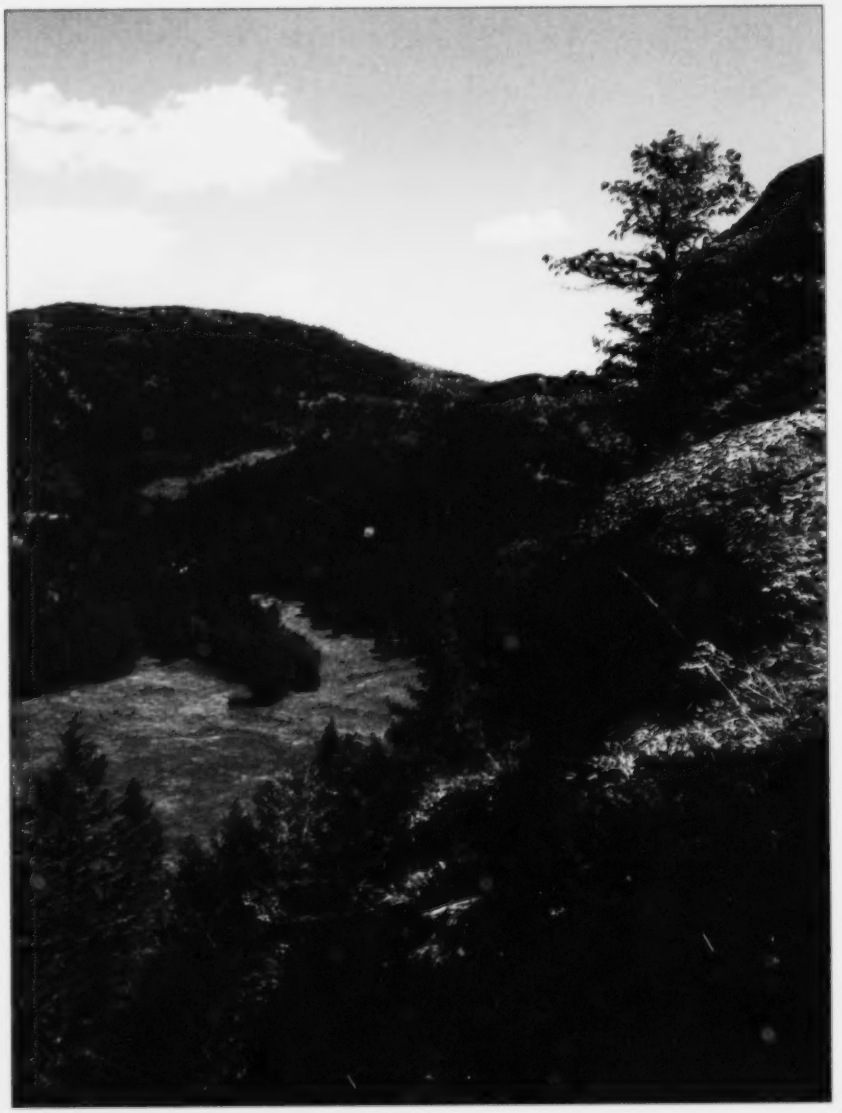
City	Land Use
Airdrie	• In 1986, Airdrie's land area was 21 km². That has increased by 50% to 31 km². • 67% of the city's land base is in residential, commercial and industrial land uses (1,249 ha). • 58% (721 ha) of the developed land area is designated for residential use, and 42% (520 ha) is designated for commercial and industrial use. • The remaining 33% of the total land base is designated for Parks and Transportation.
Lethbridge	• Before 1970, all development in the City of Lethbridge was east of the Oldman River. In the late 1960s it was decided that the new University of Lethbridge would be built west of the river, and that West Lethbridge should be the city's next major residential growth area. Residential development in West Lethbridge started in 1974 and today some 23,000 people (almost one-third of the City's population) live in West Lethbridge. • The City annexed 57 km² of land in 1984, almost doubling its area. Land was annexed in Southeast Lethbridge and on the north and west sides. In 2001, the land area was 122 km². • Currently about 40 hectares a year are being developed as new residential areas. • The industrial area in the Northeast corner of the city has more than 400 hectares available for future expansion. • Currently about 10 hectares a year are being developed for industrial purposes.
Medicine Hat	• Originally established along the river valley, the City of Medicine Hat spilled out of the valley, first to the south, then later (1950s and 60s) north of the river. Land area covered in 2001 was 112 km². • Major commercial and residential growth in the 1970s was concentrated in the southeast. This area remains the focus of commercial development today. • Also in the 1970s, the City expanded south of the Trans Canada Highway into South Ridge. This continues to be a significant area of residential development today.
Red Deer	• Historically, growth in Red Deer has been mostly single-family housing in new suburbs, developed by absorbing agricultural land on the City's margins. • The land area of the city in 2001 was 60.90 km². • The relocation of the CPR line and marshalling yards in the 1980s removed physical barriers to efficiency, mitigated noise impacts on residential uses, and made large land parcels available for commercial and residential infill. • The Council policy to retain office development in the Downtown has contributed to that area's sustained vibrancy. • Red Deer now encompasses 5,940 hectares of urban development. Its policy of retaining a 20-year land supply within its jurisdiction has required the second annexation process within a decade. • The residential land consumption rate is 40 hectares a year; the industrial land consumption rate is 8 hectares a year.

RURAL SUBDIVISION DEVELOPMENT ON THE EASTERN SLOPES OF THE ROCKIES

The southwest corner of the SAL region constitutes a significant portion of the Crown of the Continent Ecosystem (CCE). The CCE extends from the Bob Marshall Wilderness complex in Montana to the Highwood River in Alberta, and to the Elk Valley in British Columbia, covering approximately 42,000 km^2. The region is one of the most ecologically intact areas on the continent. However, the human "footprint" in the CCE has expanded significantly in recent decades.

The human footprint in southwest Alberta is most predominant along the Highway 2 corridor and around urban centres. The most dramatic increases occurred between 1980 and 2002, especially around the margins of Calgary in areas such as Okotoks, Chestermere and the M.D. of Foothills, directly west of Calgary. Factors influencing this migration from the city to rural areas include the decentralization of employment, more flexible work schedules, and advances in communication technology, accompanied by perceptions of improved environmental quality and slower pace of life. Demands for recreation and amenity resources are steadily increasing, as is expansion in both renewable and non-renewable natural resource extraction.

Rural residential development has been identified as a concern along the eastern slopes of the Rocky Mountains. Throughout this region, residential developments are replacing large mountain ranches and wildlife habitat. In addition, the implementation of low-density residential development results in the loss and fragmentation of land for farming, forestry, habitat, flood control, and other natural ecosystem functions. The human footprint, particularly structures such as housing and roads, impacts wildlife movement corridors and increases the interaction between wildlife and humans. Rural residential development can also result in the spread of invasive weeds, increase point and non-point source air and water pollution, and cause landscape alterations impeding ecological processes such as water and fire. The maps in Figure 28 show the steadily increasing growth of rural subdivision development on the Eastern Slopes of the Rockies.



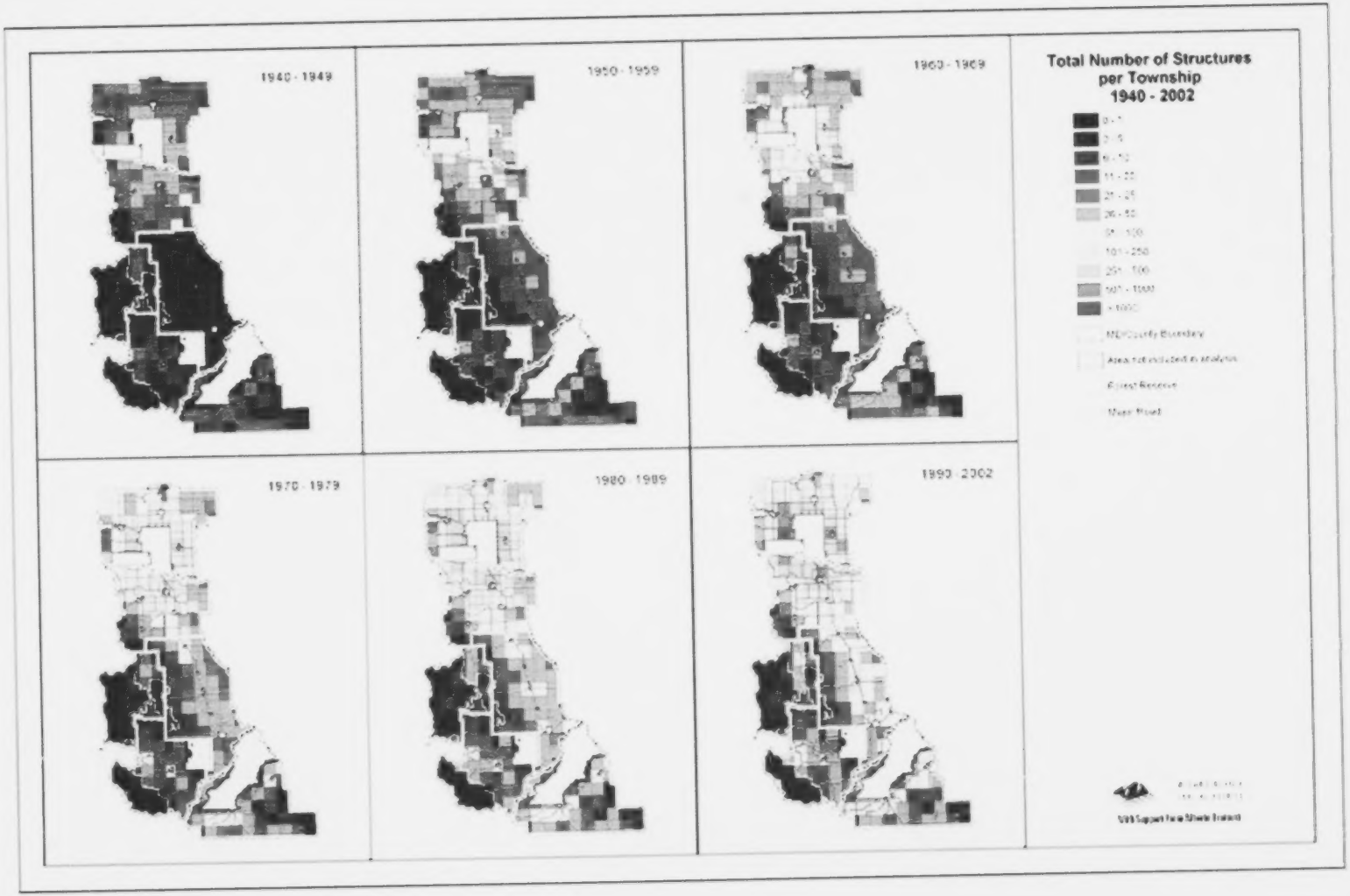


Figure 28. Rural Subdivision Development on the Eastern Slopes[5]

[5] Spatial Analysis of Rural Residential Expansion in Southwestern Alberta, Miistakis Institute, University of Calgary, September 2003 www.rockies.ca

ALBERTA'S ROADS AND RAILWAYS

How the Township System Influenced The Location of Roads and Railways

The layout of roads in the SAL region, as seen in the Access map (Figure 29), is based on the township system used for Northwest Canada, later to be the Prairie Provinces. This astronomic system was considered to be "square with the world", featuring north-south and east-west lines that follow the lines of latitude and longitude used to locate places on the earth's surface. Starting near Winnipeg, Dominion Land Surveyors established six meridians. The Principal Meridian was followed by successive Initial Meridians (the Second, Third, Fourth, Fifth, and Sixth), each about four degrees of longitude apart. The Fourth Initial Meridian later became the Alberta - Saskatchewan boundary, and the Western Provinces were extended northward from the 49th Parallel (international boundary) to the 60th Parallel, a distance of about 1220 kilometres.

Land between the Initial Meridians was then subdivided into townships - a square tract of land about 9.7 kilometres on a side. Each township was divided again into thirty-six sections (six square miles). Each section is one mile on a side and contains 640 acres. North-south road allowances run every mile apart; east-west road allowances are spaced at two-mile intervals. These road allowances provide public access to each quarter section. Sections are sometimes broken down into smaller units (called legal subdivisions) of 40 acres each; each section contains 16 legal subdivisions. These smaller tracts are used for smaller divisions of land bordering on rivers and lakes, Indian reserves, settlements, and oil and gas well spacing units.

The Prairies could not be settled without railways, so the Dominion government habitually granted large tracts of land to railway companies as an incentive to build lines. Odd-numbered sections were often used for railway land grants. Most notably, the Canadian Pacific Railway was granted 101,000 km^2 for the construction of its first line from Ontario to the Pacific. These sections are colloquially called CPR sections regardless of the railway to which they were originally granted.

Sections 11 and 29 were school sections. When school boards were formed, they gained title to these sections, which were then sold to fund the initial construction of schools. The remaining quarter sections were available as homesteads under the provisions of the Dominion Lands Act, the federal government's plan for settling the North West. A homesteader paid a $10 fee for a quarter section of their choice. If after three years the homesteader had

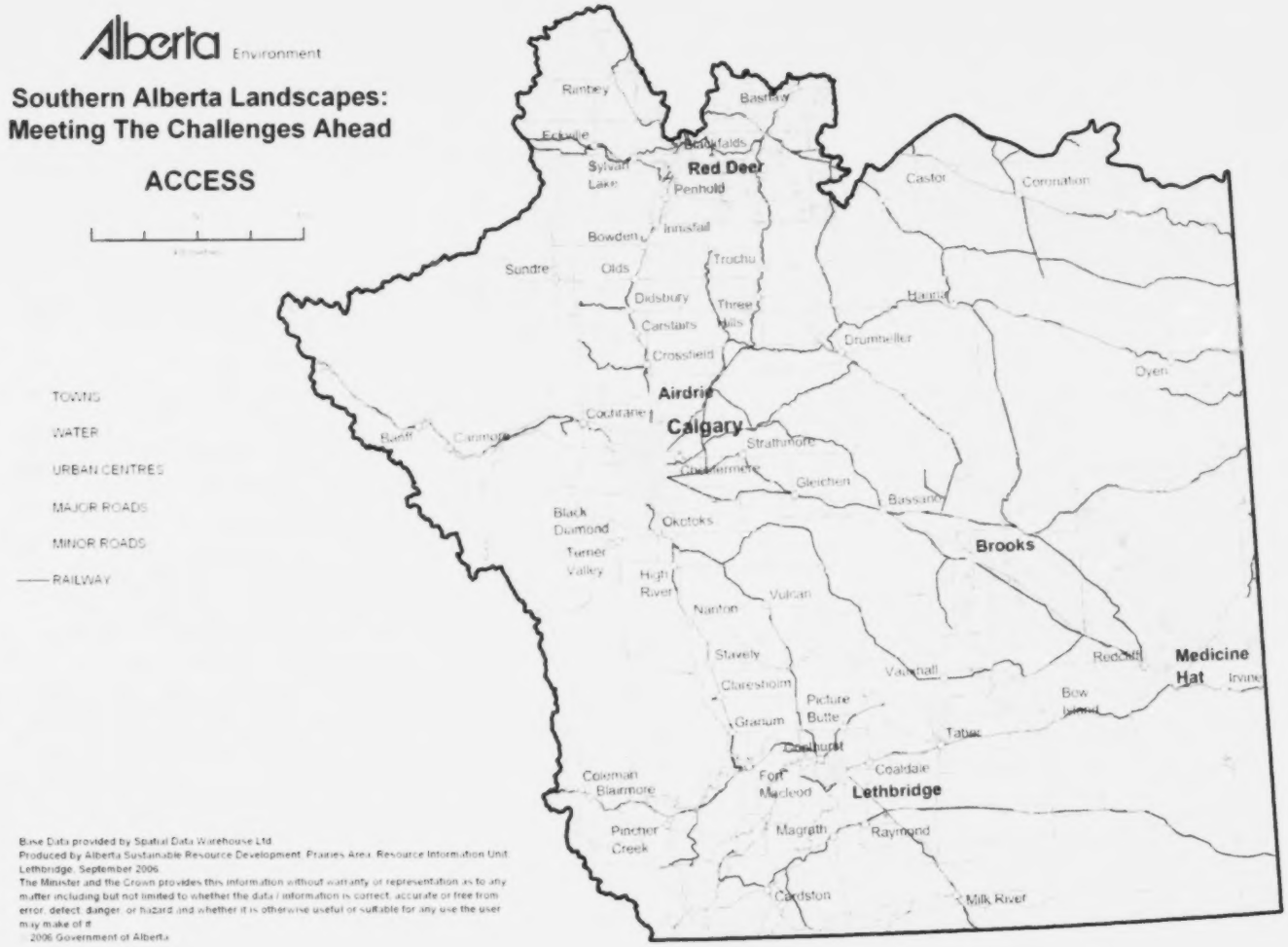


Figure 29. Transportation Access in the SAL Region

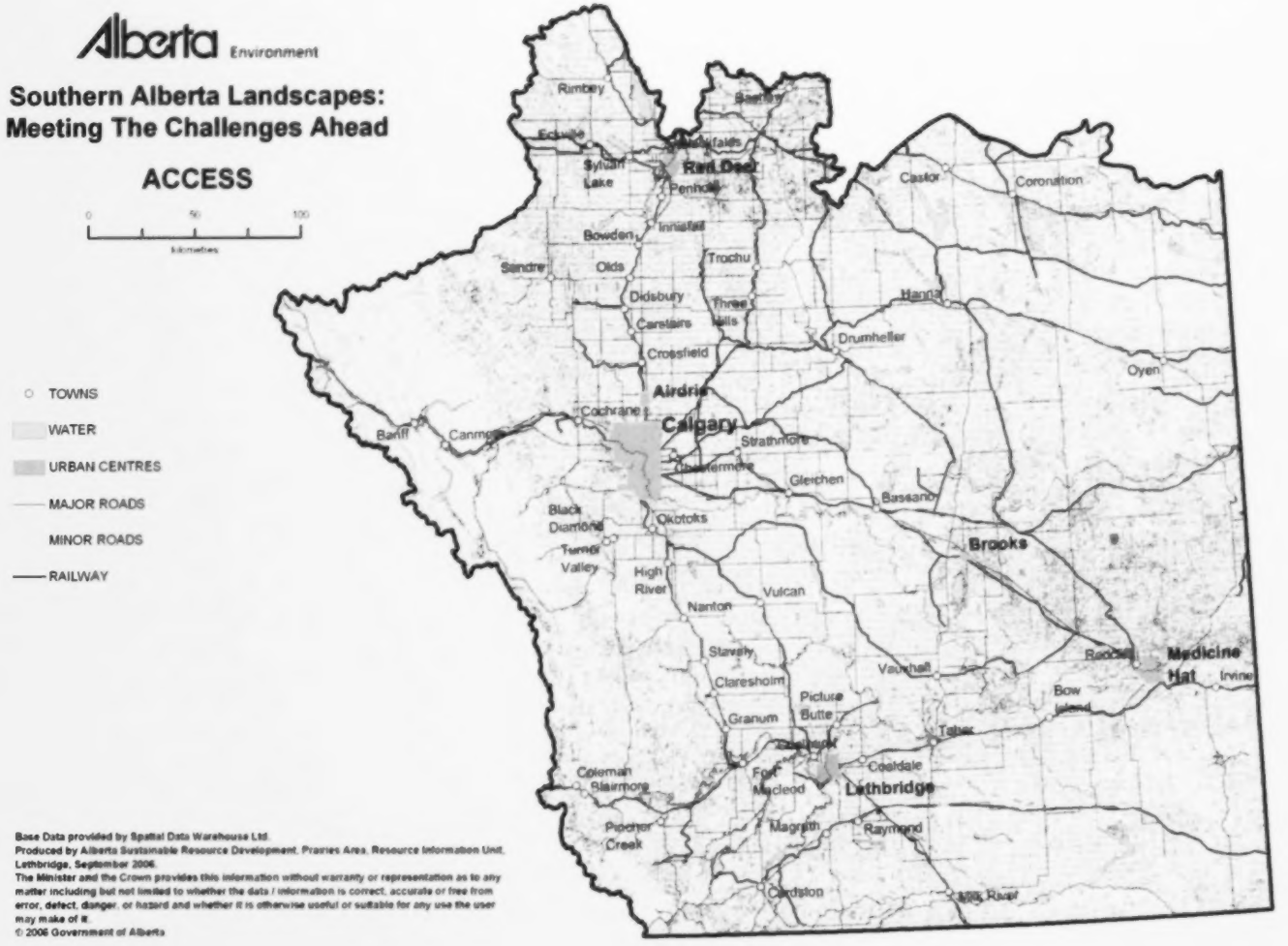


Figure 29. Transportation Access in the SAL Region

cultivated 12 hectares of land (one-fifth of the quarter) and had built a house (often just a sod house), he or she gained title to the quarter. Homesteads were available as late as the 1950s, but the bulk of the settlement of the Prairies was from 1885 to 1914.[1]

Current Status of Roads and Railways

The SAL region currently has more than 13,140 kilometres of major roads and about 109,600 kilometres of minor roads and trails. There are about 4,380 kilometres of railway track. Roads and rail lines are not evenly distributed in Alberta, being concentrated more in the southern half of the province.[2]

The majority of roadways are in the form of smaller local, or municipal, roads that provide basic land access. They link together to form a network serving the local population.

The need for transportation and the demand for energy increase with population growth and industrial development. Alberta's highway network is well established and, with ongoing maintenance and upgrading, is expected to meet most of the province's future needs.

However, new roadways may be built in the SAL region to serve future resource developments. These include:

- Increased natural gas and coalbed methane extraction,
- Growing populations along Highway 2 and on the Eastern Slopes of the Rocky Mountains, and
- Increasing numbers of tourists and tourism facilities.

In rural areas, some roads may be converted from two lanes to freeways, with interchanges and service roads. Many narrow gravel roads may also be upgraded to a higher standard. Ring roads around Calgary will likely be completed to direct regional traffic around the city.

Future plans for major provincial transportation routes that will affect the SAL area include upgrading Alberta highways in the CANAMEX corridor, to improve truck travel along the north-south corridor from Alberta to Mexico. This project includes parts of Highways 43, 16, 2, 3 and 4, between Grand Prairie and the Canada-United States border at Coutts. Scheduled upgrading and widening will eventually convert the entire corridor to four-lane standards (Alberta Transportation and Utilities 1997).

[1] McKercher, Robert B., and Wolf, Bertram (1986) Understanding Western Canada's Dominion Land Survey System. Division of Extension and Community Relations, University of Saskatchewan
[2] Alberta Environment Southern Alberta Landscapes

Agriculture and Irrigation

The past century has seen the growth of a dynamic agricultural industry in Alberta. Southern Alberta's predominantly grassland landscape has provided the necessary land base for both farming and ranching. In the SAL region, irrigation has provided opportunities for value-added production, though water supply will become the greatest limitation to agriculture's growth. As well, the yet unknown effects of climate change are certain to have an impact on the sector.

AGRICULTURE

HISTORICAL BACKGROUND

Most of Alberta's native prairie was transformed to farmland in the first part of the twentieth century. Cultivated land for crops increased consistently up to the 1980s.[1]

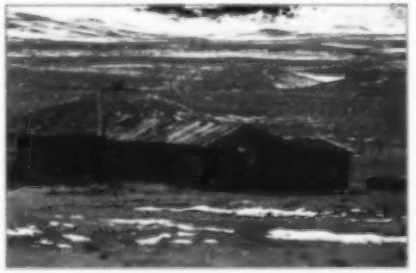
In 2001, the Agricultural Profile of the SAL region included:[2]

- Approximately 25,500 farms
- 66,560 km^2 of crop land, and
- 6,000 km^2 of irrigated land.

The first significant event in Alberta's agricultural history was the Palliser Expedition of 1857, which first surveyed the southern prairies. Although Captain John Palliser declared the area unsuitable for agriculture, this did not deter the first wave of settlers, mostly U.S. ranchers, moving north from the western states.

The completion of the Canadian Pacific Railway linking Alberta to eastern Canada provided the impetus for a significant stream of immigrants to the western prairies, mainly from Europe. This peaked just prior to the outbreak of World War One. Agriculture flourished in southern Alberta during the first quarter of the 20th century for a number of reasons:

- The development and widespread adoption of Marquis wheat, an early-maturing variety better suited to the prairie climate than previous varieties imported from Europe;
- Diversification into livestock (dairy, hogs, poultry and cattle);
- Labour-saving mechanization of agricultural production through the use of tractors and threshing machines;
- More secure water supplies provided through early irrigation projects in southern Alberta; and
- The co-operative movement, which increased farmers' marketing and political power.[2]



This all changed in 1929, however, when the stock market collapse brought about a drastic decline in commodity prices. This economic disaster coincided with a prolonged period of severe drought (known as the Dirty '30's), resulting in widespread crop failure, grasshopper plagues and badly drifting soil, a problem that was exacerbated by the common practice of summer fallowing. Many family farms lost their livelihoods and were forced to abandon their land and homes.

One positive outcome of the Dirty '30's was the subsequent adoption of improved soil conservation techniques, such as reducing tillage and summer fallow practices, strip farming and shelterbelts. Demand for agricultural products increased during and after the Second World War, especially for livestock products. Spurred on by the labour shortage brought about by the war, mechanization continued through the widespread use of tractors, swathers and combines, resulting in more efficient production. To offer some protection from the dry climate and to promote intensive cropping, the government also made a significant investment in irrigation expansion in southern Alberta. In the latter half of the 20th century, technological improvements in agricultural production and the need for economic efficiency in response to declining global commodity prices have been major drivers of intensification and specialization in Alberta's agriculture industry.

[1] Alberta Prairie Conservation Action Plan 2001-2005
[2] Agriculture Sector Story, SAL

Agriculture and Irrigation

While the number of farms in SAL has decreased from a high of about 50,000 in 1936 to the present 25,500, with more land in production the average farm size has increased. Technological advances have been a major factor influencing these trends. Mechanized farming and modern methods, such as the use of chemical fertilizers and pesticides, have enabled fewer people to do more work and produce more per hectare than was previously possible. Economic factors also favour large-scale operations.[3] However, agricultural production has become relatively more reliant on marginal land, which has climatic and physiographic limitations and is sometimes unsuitable for stable, long-term agricultural production.[4]

CROPS

A wide variety of crops are grown throughout Alberta, influenced largely by market conditions and regional growing conditions such as heat, moisture and number of frost-free days.

The four major crop categories in the SAL region are cereals, forages, pulses and oilseeds, and specialty crops.

- Cereal crops include spring- and fall-seeded wheat, malt and feed barley, oats, rye, durum, and triticale (a hybrid of wheat and rye).
- Forage crops include alfalfa, brome grass, timothy, wheatgrass, clover, tame hay and wild rye. More than 20,000 km^2 is also in tame pasture.
- The principal oilseed crops in Alberta are canola and flax.
- Specialty crops include field peas, mustard, lentils, dry beans, fababeans, safflower, sunflower, canaryseed, herbs and spices, sugar beets, potatoes, corn and other vegetables grown for commercial production. The term "special crops" refers to those crops not included in horticultural crops or major grains and oilseeds.

The area on which the major crop types are grown has been relatively stable since the early 1990s (Figure 31).

The most important crop types in Alberta, based on production (Figure 30), area (Figure 32) and sales, are wheat, barley, canola and tame hay.[6]

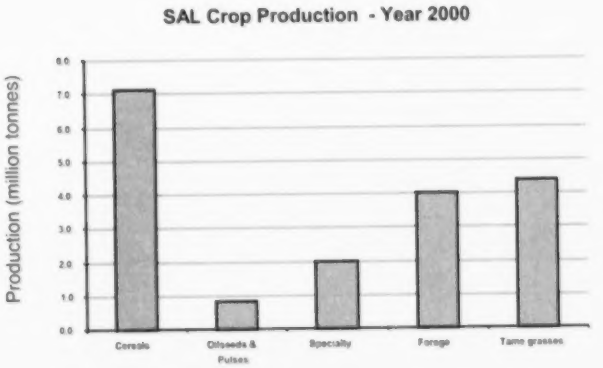


Figure 30. SAL Crop Production

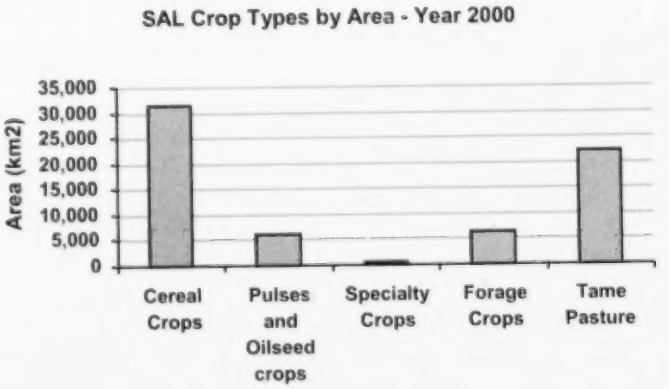


Figure 31. SAL Crop Types by Area

[3] Alberta's State of the Environment Report: Terrestrial Ecosystems
[4] Proceedings of the Fifth Prairie Conservation and Endangered Species Conference, Natural History Occasional Paper No. 24, Rural and Small Town Canada – Analysis Bulletin, Statistics Canada
[5] Alces and Malatest, SAL Project
[6] Alberta's State of the Environment Report: Terrestrial Ecosystems

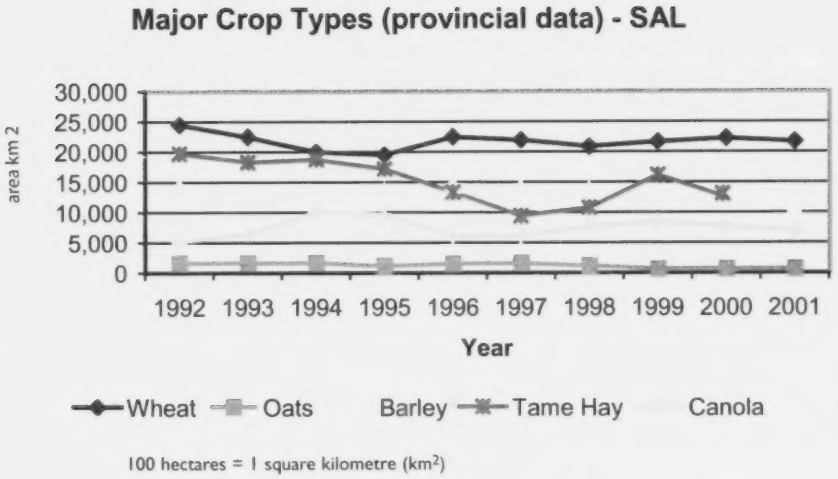


Figure 32. Major Crop Types - SAL

Potatoes are also a significant crop in the SAL region. Commercial potato production was established in Alberta in the 1930s. In 1937, growers produced about 14 tonnes per hectare of table potatoes on 2400 hectares of irrigated land. Current potato production on irrigated land is more than 14,000 hectares a year, and yields have more than doubled.[7]

Processing and fresh market potatoes are produced in southern Alberta under irrigation. Processing potatoes are grown on approximately 37,000 acres (150 km^2), and fresh market potatoes are grown on about 3000 acres (12 km^2).[8] Approximately 65% of the crop goes to processing plants in the Taber, Lethbridge and Calgary areas.

IRRIGATION

Southern Alberta's irrigation agriculture, accounting for more than 70% of the irrigated farm acreage in Canada, is a significant economic force, adding about 35,000 jobs and nearly $1 billion a year to the provincial economy.

Moisture is the limiting factor to crop growth in the warmer, drier, brown and dark brown soil zones of southern Alberta. Irrigated crops account for about 12% of Alberta's agricultural production, even though irrigated land constitutes only 4.5% of the total cultivated area. Irrigation greatly increases yields over what would be expected without the additional moisture. Irrigation also enables the growing of crops that could not survive on the amount of moisture available on dryland farms in Alberta.[9]

[7] Irrigation in Alberta, AAFRD, 2000
[8] Roger Holm, AAFRD, 2005
[9] Alberta's State of the Environment Report: Terrestrial Ecosystems. Major reference for irrigation: Irrigation in Alberta, 2000

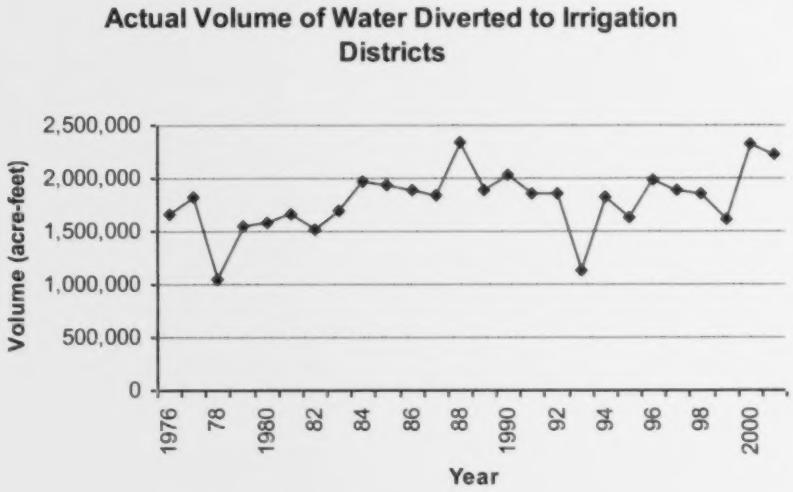
Agriculture and Irrigation

After Confederation in 1867, the new Canadian government was keen to encourage settlement. The search for water in this dry landscape spurred pioneering farmers to dig wells, build small dams and divert water for small-scale irrigation, beginning with Alberta's first irrigation project near Calgary in 1879. As such diversions multiplied, the federal government passed the Northwest Irrigation Act of 1894, which set two important precedents: government ownership of and control over water resources, and allocation of water licenses on a first-in-time, first-in right basis.

The first large-scale irrigation systems were corporate investments, beginning with a 1900 canal project southwest of Lethbridge, followed by CPR diversions downstream of Calgary that brought water to 240,000 hectares of land. In 1914, the Alberta government passed the Irrigation Districts Act, allowing landowners to organize themselves into local cooperatives for building and managing large irrigation projects. This concept of farmer-owned irrigation districts was unique to Alberta and eventually led to the formation of 13 such districts, all in the SAL region (see Figure 34).

The Great Depression of the 1930s reinforced the need for continued irrigation funding from both levels of government. Water storage and delivery systems were constructed and later rebuilt and expanded, using more modern technologies as the infrastructure aged. Subsequent investments by the province allowed irrigation acreage to increase by 50% between 1970 and 1980. The trend to expansion continued with the construction of a large dam and reservoir on the Oldman River in the early 1990s. Rapid expansion was aided by centre pivot sprinklers, allowing larger farm areas to be watered with less labour, and by infrastructure repairs that reduced evaporation and seepage losses.[10]

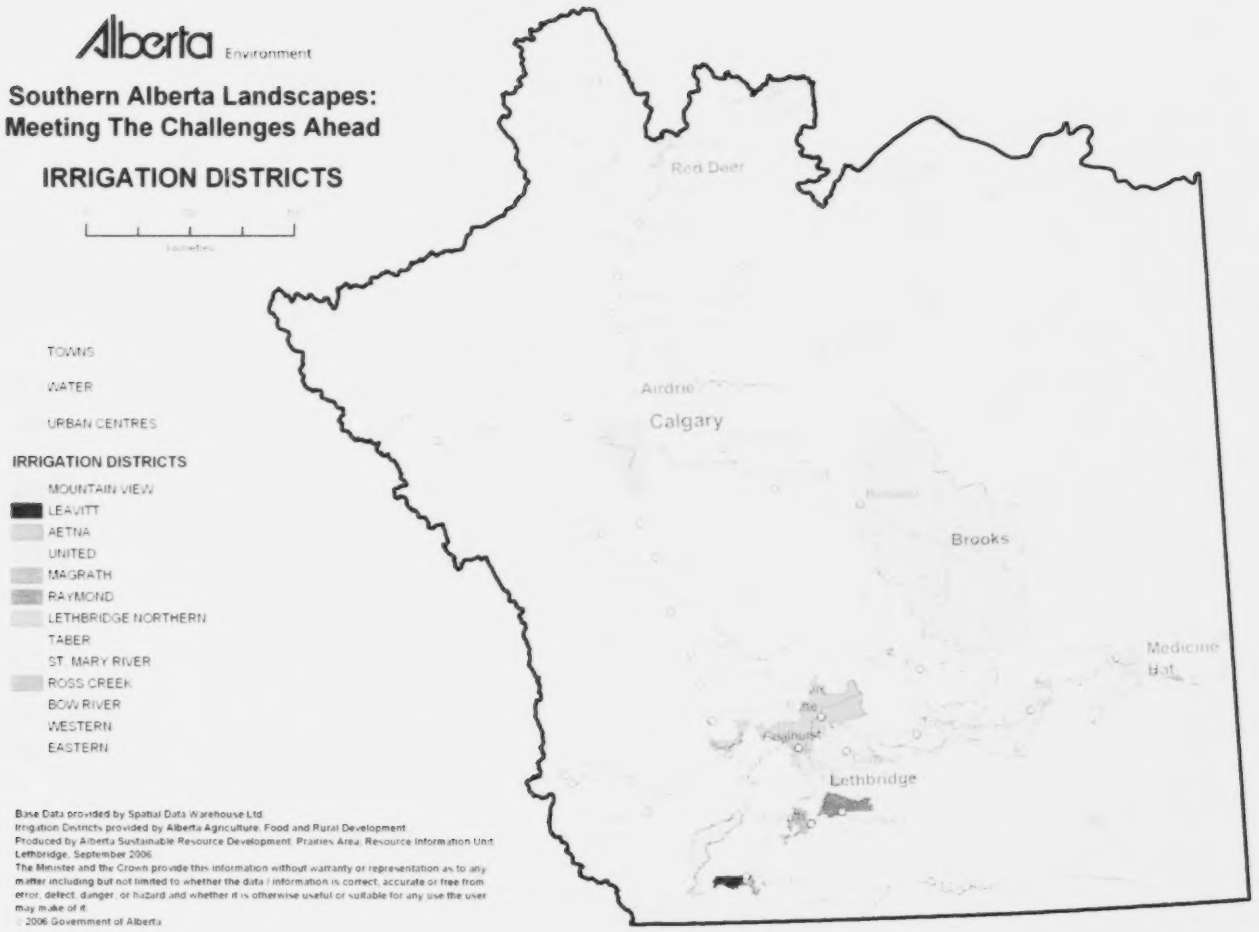
Figure 33 shows the actual volume of water diverted to irrigation districts from 1976 to 2000. Variations are due to changes in weather, changes in crop types and markets, and improvements to on-farm and system irrigation technologies mentioned above.



1 acre-foot = 1.2335 cubic decametres (dam^3)

Figure 33. Actual Volume of Water Diverted to Irrigation Districts

[10] 1996 Alberta State of the Environment Report: Aquatic Ecosystems


Alberta Environment
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Meeting The Challenges Ahead
IRRIGATION DISTRICTS
TOWNS
WATER
URBAN CENTRES
IRRIGATION DISTRICTS
MOUNTAIN VIEW
LEAVITT
AETNA
UNITED
MAGRATH
RAYMOND
LETHBRIDGE NORTHERN
TABER
ST. MARY RIVER
ROSS CREEK
BOW RIVER
WESTERN
EASTERN
Base Data provided by Spatial Data Warehouse Ltd.
Irrigation Districts provided by Alberta Agriculture, Food and Rural Development.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit,
Lethbridge, September 2006.
The Minister and the Crown provide this information without warranty or representation as to any matter including but not limited to whether the data / information is correct, accurate or free from error, defect, danger, or hazard and whether it is otherwise useful or suitable for any use the user may make of it.
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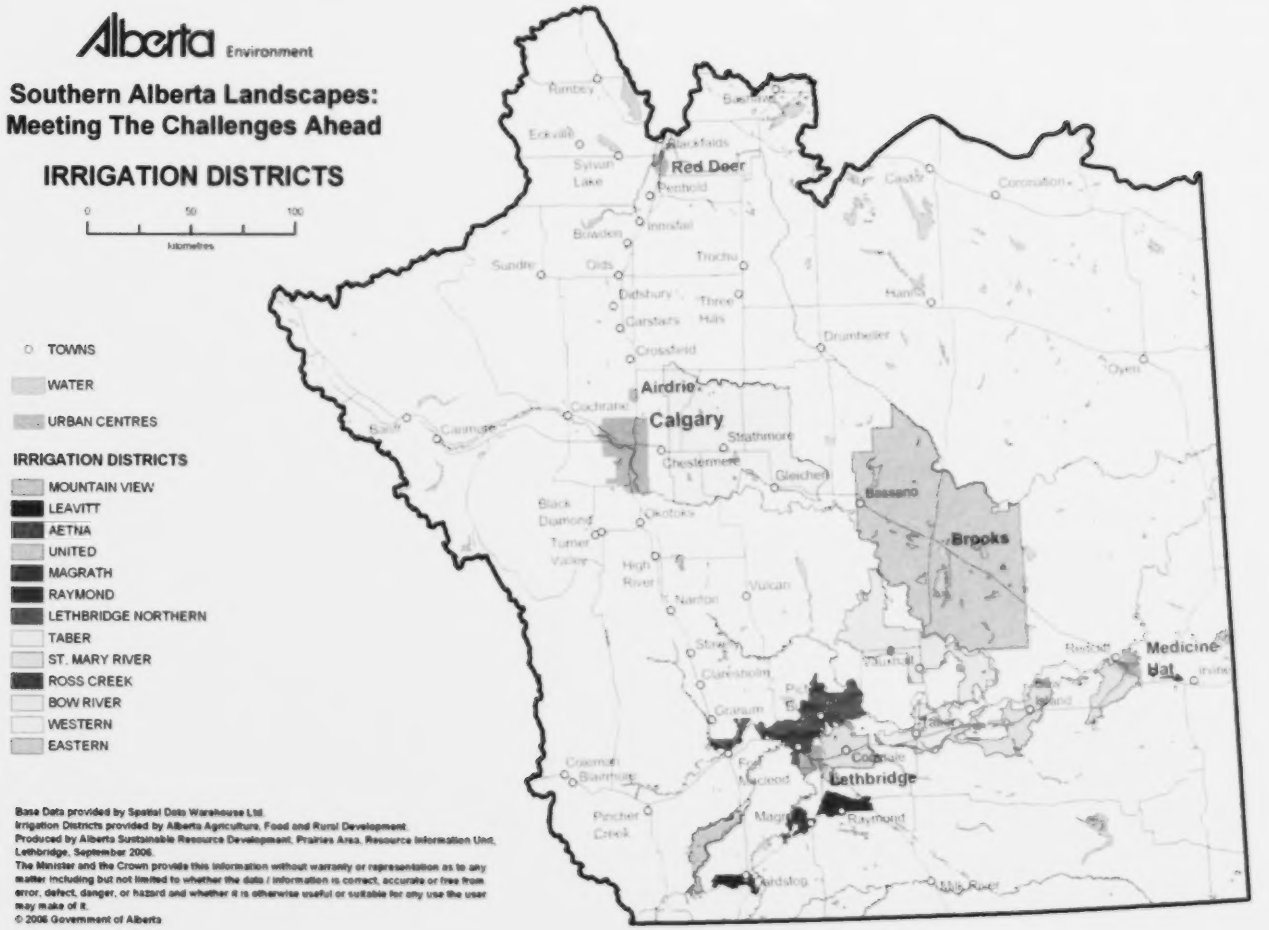
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Fort Macleod
Lethbridge

Figure 34. Alberta's Irrigation Districts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UNITED
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ST. MARY RIVER
ROSS CREEK
BOW RIVER
WESTERN
EASTERN
Base Data provided by Spatial Data Warehouse Ltd.
Irrigation Districts provided by Alberta Agriculture, Food and Rural Development.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge, September 2006.
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© 2006 Government of Alberta
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Lethbridge

Figure 34. Alberta's Irrigation Districts

Agriculture and Irrigation

Table 10. Alberta's Irrigation System

	Length of Distribution System	Hectares Under Irrigation
IRRIGATION DISTRICTS		
Aetna ID	27 km	781 ha
Bow River ID	1,058 km	80,209 ha
Eastern ID	1,784 km	111,267 ha
Leavitt ID	56 km	1,862 ha
Lethbridge Northern ID	650 km	49,526 ha
Magrath ID	106 km	4,528 ha
Mountain View ID	35 km	426 ha
Raymond ID	247 km	13,055 ha
Ross Creek ID	20 km	427 ha
St. Mary River ID	1,719 km	138,712 ha
Taber ID	364 km	31,110 ha
United ID	227 km	6,992 ha
Western ID	1,077 km	27,375 ha
Private Licenses (2,700)	---	112,435 ha
Total length of system	**7,370 km**	**578,705 ha**
Total land assessed for irrigation	**(5,787 km²)**	

Currently, the 13 irrigation districts in the South Saskatchewan River Basin serve approximately 5,200 km² of land in southern Alberta (Table 10).[11]

Storage reservoirs and canal systems throughout the basin carry water to dozens of communities and thousands of farmsteads for domestic use and irrigation. Irrigation for these lands comes almost exclusively from surface waters.[12]

In addition to the 13 irrigation districts in the SSRB, private irrigation projects have been authorized to use Alberta's water resources. The largest private license in the province is the Blood Tribe Agricultural Project, which obtains water from the Waterton, Belly and St. Mary Rivers.

Considering the increases in primary production due to irrigation and the spin-offs in agri-food processing, this level of irrigation contributes about $832 million or 18.4% to the agri-food gross domestic product for Alberta. In addition, the irrigation infrastructure provides significant non-irrigation benefits related to municipal and industrial water supplies, recreation, tourism, and wildlife.

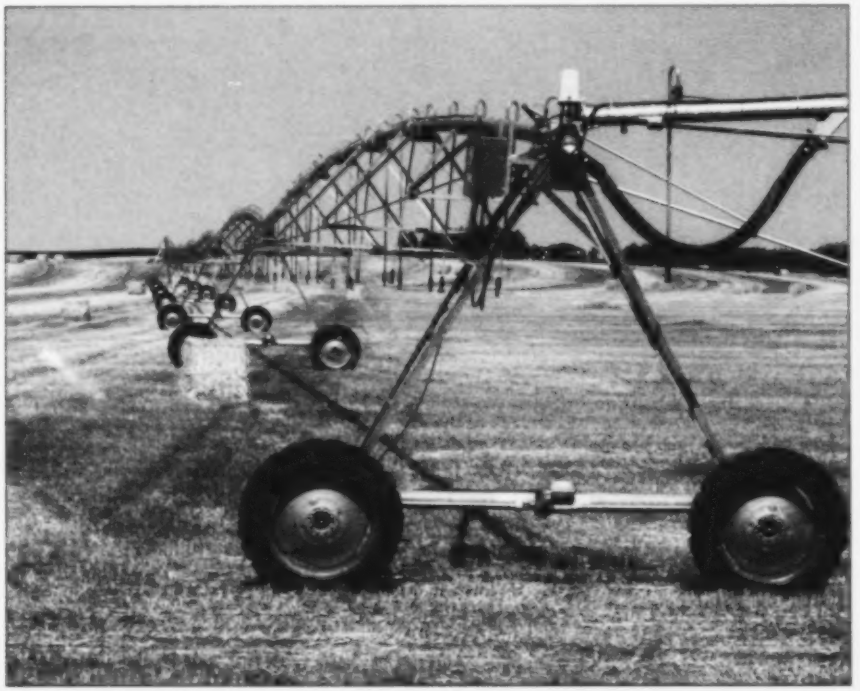
[11] Irrigation in Alberta, AAFRD, 2000

[12] Alberta Irrigated Projects Association, South Saskatchewan River Basin: Irrigation in the 21st Century, 2002, http://www.aipa.org/Adobe_Files/21st_Century_Vol_01_ToC.pdf

CROPS GROWN AND IRRIGATED IN THE SAL REGION

Though irrigation is important to crop production in the SAL region, only 6,500 km², or 9.74% of a total of 66,730 km² of cropland are irrigated (Figures 35 and 36).[13]

- Cereal crops occupy 31,543 km² of the SAL region; 2,175 km² (6.9%) is irrigated.
- Pulses and oilseed crops occupy 5,954 km²; 317 km² (5.3%) is irrigated.
- Specialty crops occupy only 585 km² but 538 km² (92%) is irrigated.
- Many forage crops are also grown on irrigated land; 6,490 km² are planted, of which 2,750 km² (42.4%) are irrigated.
- Tame pasture occupies 22,156 km²; 712 km² (3.2%) is irrigated.



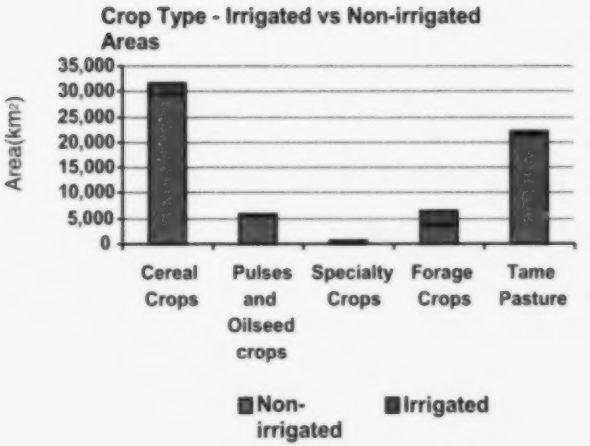


Figure 35. SAL Crop Type – Irrigated & Non-Irrigated

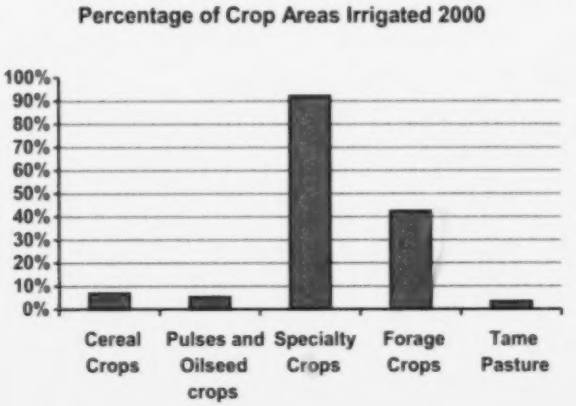


Figure 36. SAL Percentage of Crop Areas Irrigated

[13] SAL Technical Team, Irrigation, 2005

Agriculture and Irrigation

LIVESTOCK

Over the years, Alberta's irrigation systems have also helped create Canada's largest beef cattle industry and have fed the rapid growth of Alberta's pork, poultry, specialty meat, and dairy industries.[14]

The main livestock types are cattle (beef and dairy), hogs, poultry (eggs and meat), sheep (wool and meat), and horses (recreation, sport, meat, and pregnant mare urine). Recently, farmers have shown a growing interest in specialty livestock. A small number of farms raise animals such as alpacas, angora goats, llamas, bison, elk, wild boars, and even emus and ostriches. Specialty livestock are raised for breeding stock, recreation, meat and other products.[15]

Figure 37 shows the numbers of cattle, swine, horses and chickens in the SAL region, and the increases in numbers from 1926 to 2001. Currently, there are approximately 4.5 million head of cattle in the region, which represents approximately 68% of the cattle raised in the province.

Of the top 30 regions in Canada having the largest number of animal units (on May 15, 2001), more than half (17) were in Alberta. They accounted for 18.7% of all Canadian livestock. Lethbridge topped the list with 427,000 animal units or 3.1% of all livestock. In 2001, Lethbridge, which also topped the previous list of the highest number of animal units, was in the fifth position in terms of density, with 143 animal units per square km.[16]

Current range management strives for moderate grazing pressure. Grazing systems that maintain the health of the prairie and avoid degradation of areas where livestock may concentrate, such as riparian habitats, can also promote biodiversity while maintaining high productivity.[17] Unimproved grasslands and pastures represent the original ecosystem in the drier regions. Improved pasture is the area of grassland that has been reseeded, fertilized or has had some degree of weed control.[18]

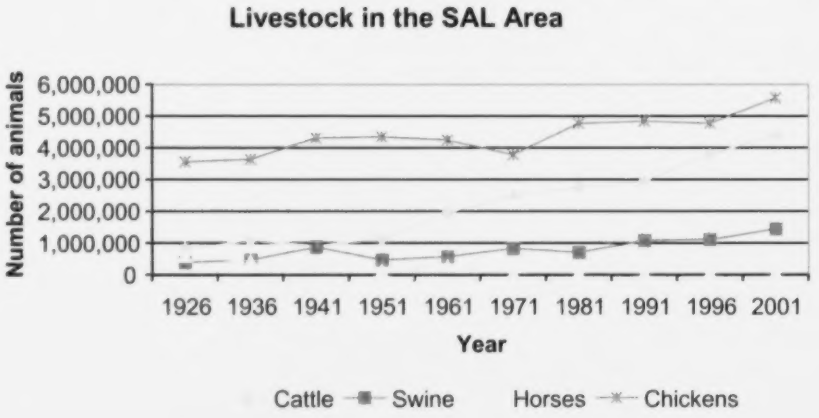


Figure 37. Trends in Livestock Production, 1926 - 2001

[14] State of Alberta's Water Resources, 2004
[15] Alberta's State of the Environment Report: Terrestrial Ecosystems
[16] A Geographic Profile of Canadian Livestock: 1991 – 2001, Statistics Canada
[17] Prairie Conservation Forum: Prairie Ecosystem Management: An Alberta Perspective
[18] Use Of Remote Sensing For Ecological Monitoring In Canada, Environment Canada http://www.eman-rese.ca/eman/reports/publications/remote-sens/part6.html

Figure 38 shows there remain large areas of "unimproved pasture," although those areas have decreased and improved pasture area has increased. Figure 39 shows the increase in density of cattle grazing on unimproved land and the decrease in density of cattle grazing on improved land.

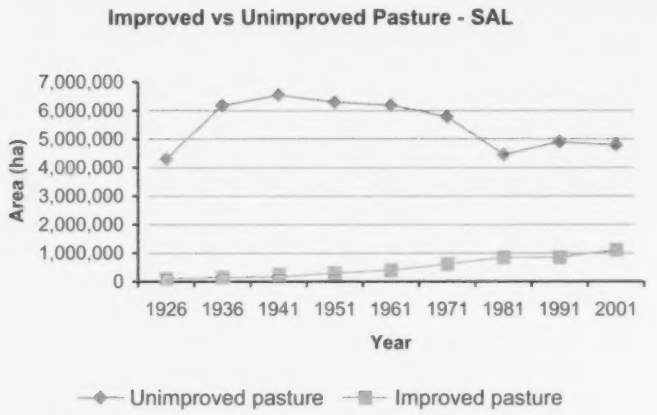


Figure 38. Improved vs Unimproved Pasture

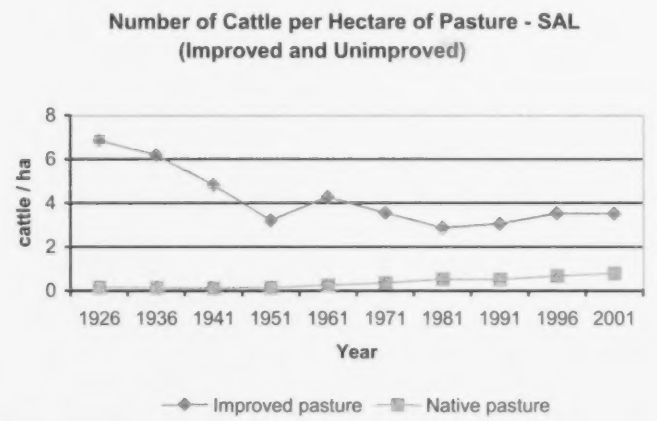


Figure 39. Cattle per Hectare of Pasture

CONFINED FEEDING OPERATIONS

Figure 40 shows the location of Confined Feeding Operations in the SAL region.

The Agricultural Operation Practices Act defines a confined feeding operation as fenced or enclosed land or buildings where livestock are confined for the purpose of growing, sustaining, finishing or breeding by means other than grazing, and any other building or structure directly related to that purpose, but does not include residences, livestock seasonal feeding and bedding sites, equestrian stables, auction markets, race tracks, or exhibition grounds."[19]

Alberta's Agricultural Operation Practices Act (AOPA) regulations, which came into effect on January 1, 2002, launched improved standards for environmental management in Alberta's livestock industry. The siting requirements of AOPA are intended to ensure that confined feeding operations (CFOs) are environmentally sustainable and are located to reduce potential impacts on neighbours.

The Natural Resources Conservation Board (NRCB) is assigned the responsibility of administering CFO applications and the approval process, and with monitoring compliance with province-wide standards.

[19] Natural Resources Conservation Board, http://www.nrcb.gov.ab.ca/cfomain/default.aspx

Southern Alberta Landscapes:
Meeting The Challenges Ahead

CONFINED FEEDING OPERATIONS

Figure 40. Location of Confined Feeding Operations in the SAL Region

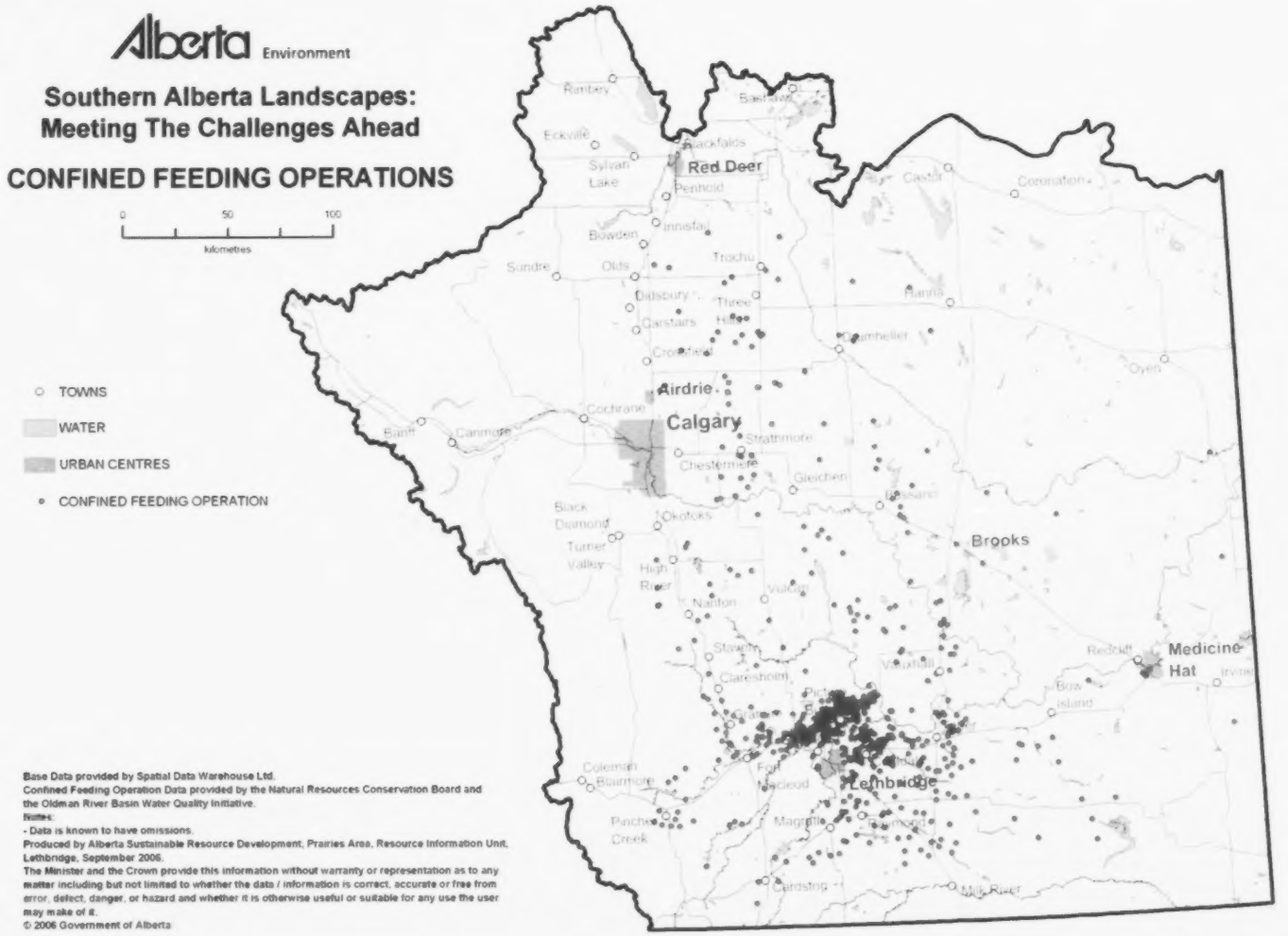

Alberta Environment
Southern Alberta Landscapes:
Meeting The Challenges Ahead
CONFINED FEEDING OPERATIONS
0
50
100
kilometres
TOWNS
WATER
URBAN CENTRES
CONFINED FEEDING OPERATION
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Lethbridge
Base Data provided by Spatial Data Warehouse Ltd.
Confined Feeding Operation Data provided by the Natural Resources Conservation Board and the Oldman River Basin Water Quality Initiative.
Notes:
- Data is known to have omissions.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge, September 2006.
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Figure 40. Location of Confined Feeding Operations in the SAL Region

AGRI-FOOD PROCESSING

In southern Alberta, there are more than 130 agri-food processing companies, accounting for about 50% of Alberta's total food processing sales. The region's food processing industry is also quite diverse. It includes meatpacking, dairy (milk, cheese and other dairy products), feed, cereal grain and flour (mills and wholesale bakeries), canola processing, potatoes (chips, frozen products and fresh market), frozen fruits and vegetables, dry beans, specialty products (such as sunflower snacks and bird seed), and sugar. Federally inspected cattle slaughter plants include Lakeside Packers Ltd. of Brooks, Cargill Ltd. of High River, XL Foods Inc. of Calgary, and Bouvry Export Ltd. of Fort Macleod.[20]

Pork slaughter and processing plants operating in the SAL region include Fletcher's Fine Foods Ltd., of Red Deer, Maple Leaf Meats Inc. of Lethbridge, and Trochu Meat Processors Ltd. of Trochu.[21]

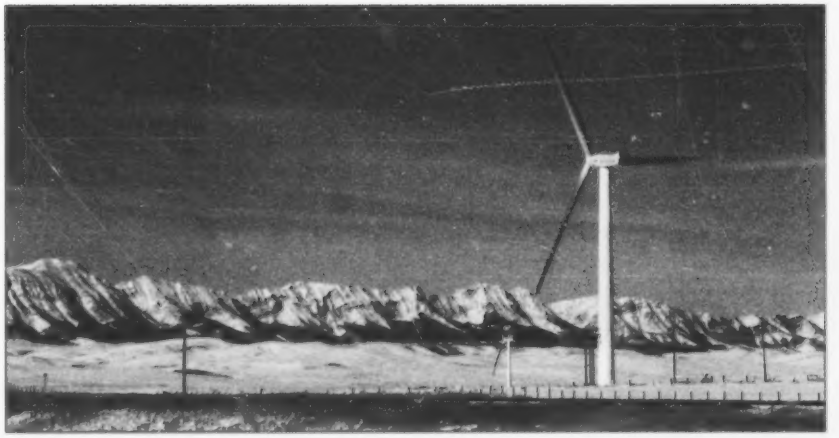
[20] For information on the Palliser region of SAL and some of the agri-food industries in the area, consult http://www.palliseralberta.com/Business/agrifood.htm
[21] Agriculture Canada http://www.agr.gc.ca/mad-dam/e/bulletine/v13e/v13n19e.htm

Energy and Mining

Alberta possesses massive energy reserves in the form of oil, natural gas and coal. In 2005, the province produced 10,794 petajoules of energy from all sources, including renewable energy sources such as hydro and wind power. This would be enough energy to supply almost 40 million people for all uses (from housing and transportation to local services and industry).[1]

About 70% of the energy produced in Canada from hydrocarbon reserves comes from Alberta. Approximately 83% of the country's natural gas reserves, 68% of conventional oil reserves, 100% of bitumen (oil sand) reserves, and 60% of coal reserves are found in the province.[2]

In addition, Alberta has a variety of non-energy resources such as metallic minerals, industrial minerals, and sand and gravel deposits. With the exception of oil sands, all these resources can be found in the SAL area.



HISTORY OF ENERGY AND MINING

Important Dates for Non-energy Mineral Development

1670 to 1869: Mineral rights were owned by the Hudson's Bay Company.
1880: Clays from the Medicine Hat area were first used for bricks.
1910 to 1930: The local building stone industry reached its peak.
1930: Mineral rights were transferred to the provinces and the Department of Lands and Mines was established.
1949: The Mines and Minerals Act was passed.
1970: Calgary began an economic boom, resulting in the first gravel rush.
1970: Ammonite shells were found in Alberta.
1982: Alberta became the cement production centre of Western Canada.
1990: Calgary began another economic boom, resulting in a second gravel rush.

Important Dates for Hydrocarbon Development

1882: Lethbridge coalmines were opened.
1887: Banff and Canmore coalmines were opened.
1901: Crowsnest Pass coalmines were opened.
1901: Alberta's first producing oil well came on line in Waterton.
1909: The first major gas field was discovered at Bow Island.
1914: A major oil and gas field was discovered in Turner Valley.
1938: The Petroleum and Natural Gas Board was established.
1950: Early petrochemical operations began to be developed.
1970: Petrochemical facilities were built in Medicine Hat and Joffre.
2004: Oil and gas drilling activity reached record highs.

Important Dates for Renewable Energy Development

1911 to 1972: 13 Hydroelectric Power Plants were built in Alberta.
1996: the Castle River Wind Farm was built near Pincher Creek.
2003: the McBride Lake Wind Farm was built near Fort Macleod.
2004: the Summer View Wind Farm was built near Pincher Creek.

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[1] Natural Resources Canada, Energy Efficiency Trends in Canada 1990-2003, http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/data_e/trends05/chapter2.cfm?attr=0

[2] Crude Oil Production data (2003), National Energy Board; Conventional Oil Reserve data (for year-end 2001), NEB; Marketable Natural Gas data (2003), Alberta Department of Energy; Natural Gas Reserve data (2005), DoE; Liquefied Petroleum Gases data (2004), DoE)

[3] The City of Red Deer, http://www.city.red-deer.ab.ca/

[4] Alberta Energy Annual Report 2004-2005, p. 26, http://www.energy.gov.ab.ca/docs/aboutus/pdf/AR2005.pdf

Energy and Mining

HYDROCARBON DEVELOPMENT IN ALBERTA

ALBERTA'S OIL RESERVES AND PRODUCTION

Crude Bitumen (Oil Sands)

The total established reserves of crude bitumen in Alberta are 27.6 billion m^3 (approximately 174 billion barrels). Only 2.8% of the initial established crude bitumen reserves have been extracted since commercial production started in 1967.

In 2005 alone, a total of 61.7 million m^3 was produced in the province, the equivalent of 169,000 m^3/day (more than 1.06 million barrels per day).

Crude Oil

The Energy and Utilities Board estimates the remaining established reserves of conventional crude oil in Alberta to be 255 million m^3 at December 31, 2005, a 2% increase from December 31, 2004. The province's remaining conventional oil reserves have declined by half since 1990.

	Remaining	Initial
Established Reserves (million m^3)	255	2,704
2004/2005 Reserves Change (million m^3)	5.6	38.8
Ultimate Potential (million m^3)	426	3,130

Based on its 1988 study, the EUB estimates the ultimate potential recoverable reserves of crude oil at 3130 million m^3 (almost 19.7 billion barrels).[5]

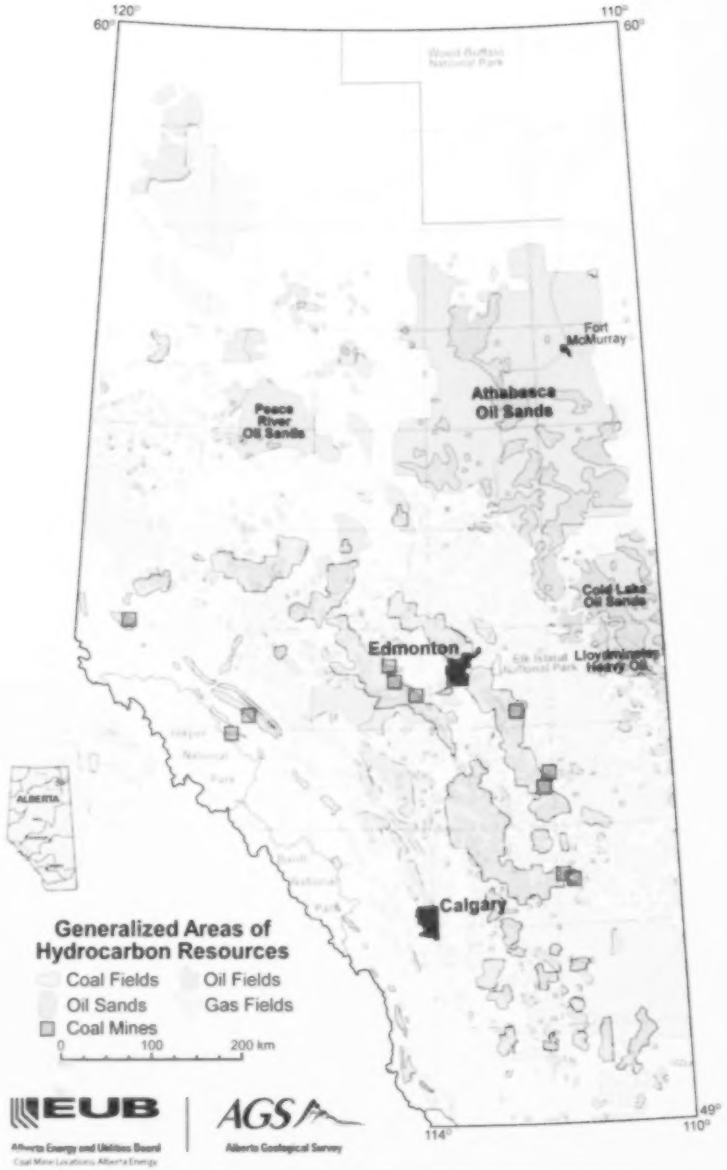


Figure 41. Generalized Areas of Hydrocarbon Resources[6]

[5] EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook/Overview
[6] Alberta Energy, http://www.energy.gov.ab.ca/51.asp

Energy and Mining

ALBERTA'S NATURAL GAS RESERVES AND PRODUCTION

Natural gas is currently produced from two main sources in Alberta. Conventional sources account for the majority of natural gas production, but production from coal, or coalbed methane (CBM), has grown rapidly in the past two years. Natural gas production from sources such as shale gas may prove to be an additional reserve of energy for the near future.

Coalbed Methane

CBM has been recognized as a commercial supply of natural gas in Alberta for only a few years. Activity in CBM has increased dramatically from a few test wells in 2001, to more than 5000 wells having some production by 2005.

At the end of 2005, established reserves of CBM in Alberta were estimated to be 20.9 billion m^3.

Conventional Natural Gas

At the end of 2005, Alberta's established reserves of natural gas stood at 1120 billion m^3. In 2005, Alberta produced 137 billion m^3 of marketable natural gas, of which 8 billion m^3 was from CBM.

Some 146 billion m^3 of marketable gas were added to Alberta's recoverable reserves in 2004. These additions are a result of discovering new reserves and reassessing reserves already discovered. Total additions in 2004 outstripped production, contributing to a 0.4 per cent increase in the remaining established reserves of marketable gas, to 1127 billion m^3 as of year-end 2004.[7]

Total reserves additions of conventional natural gas have failed to keep pace with production, which has increased significantly since 1992. Alberta's remaining established reserves of marketable gas have decreased by about 40 % since 1982.[8] Several major factors have an impact on natural gas production, including natural gas prices, drilling activity, the accessibility of Alberta's remaining reserves, and the performance characteristics of individual wells.[9]

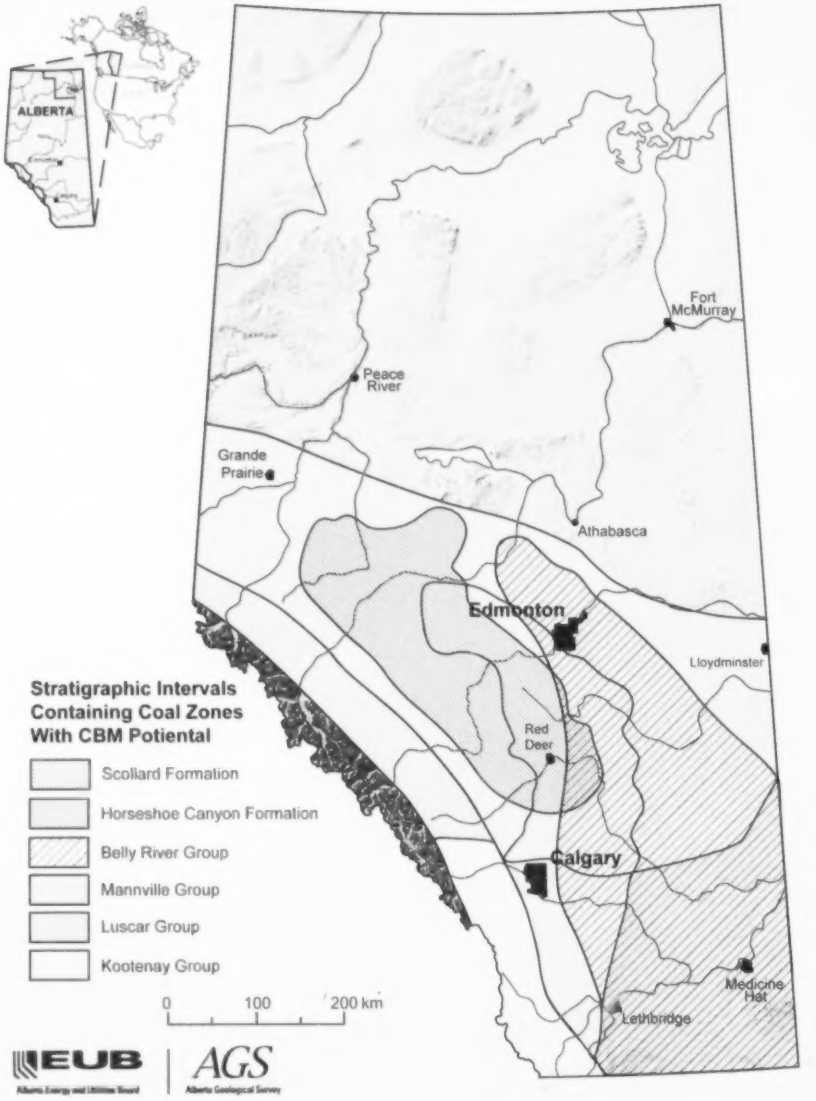


Figure 42. Stratigraphic Intervals Containing Coal Zones with CBM Potential

[7] EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook2006-2015
[8] EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook2006-2015
[9] EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook2006-2015 http://www.eub.ca/docs/products/STs/st98_current.pdf

Energy and Mining

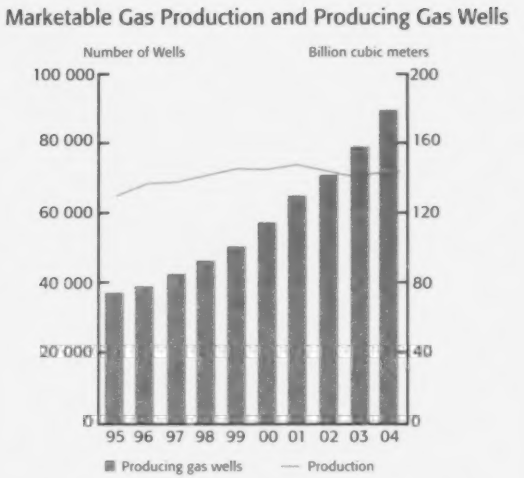


Figure 43. Marketable Gas Production and Producing Gas Wells

Though gas production stabilized after reaching its peak in 2001, the number of producing gas wells has increased significantly year after year. Much of Alberta's gas development has centered on shallow gas wells in southeast Alberta, where more than half of the province's producing gas wells are located. In 2004, a record number of gas wells were drilled and marketable gas production grew by 1.2%. The EUB anticipates that shallow drilling will continue to account for a large share of the activity in the province over the next few years. Over time, however, the focus of exploration will likely shift to the western portion of the province and more productive wells.[10]

ALBERTA's ETHANE, OTHER NATURAL GAS LIQUIDS (NGLs), AND SULPHUR

Ethane

Ethane is a colourless, odourless gas mainly used in Alberta as a petrochemical feedstock. It is also known as dimethyl. Remaining established reserves of extractable ethane are estimated at 121 million m^3 as of year-end 2005.

In 2005, the production of specification ethane remained similar to the 2004 level of 40,100 thousand m^3/day.

OTHER NATURAL GAS LIQUIDS

The remaining established reserves of other NGLs - propane, butanes, and pentanes - decreased from 169 million m^3 in 2005 from 172 million m^3 in 2004.

Sulphur

Remaining established reserves of sulphur are 85 million tonnes from natural gas and the upgrading of bitumen from mining areas under active development. Sulphur demand is not expected to increase significantly.

ALBERTA'S COAL RESERVES AND PRODUCTION

Coal

The current estimate for remaining established reserves of all types of coals in Alberta is estimated at about 34 billion tonnes. Alberta's total coal production in 2005 was 30 million tonnes of marketable coal, most of which was sub-bituminous coal. Alberta's coal reserves represent over a thousand years of supply at current production and demand levels. However, sub-bituminous coal production is expected to increase during the next 10 years, to meet demand for additional electrical generating capacity.[11]

[10] EUB Statistical Series (ST) 2004-98: Alberta's Reserves 2003 and Supply/Demand Outlook 2004-2013
[11] EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook/Overview

Figure 44. Distribution of Coal by Rank

NON-ENERGY MINERAL DEVELOPMENT IN ALBERTA

Non-energy minerals are legally defined in Alberta as minerals other than petroleum, natural gas, coal, or oil sands.

Metallic Minerals and Precious and Semi-precious Stones

Metallic minerals currently produced in Alberta include gold and iron. Ammonite shell is quarried in the SAL Region. There are no underground mines active in Alberta at present.

Exploration work continues for gold, platinum group metals, uranium, zinc, lead, and diamonds.

A proposal for a magnetite (iron) operation near the Crownest Pass is under consideration. This operation would supply magnetite to coal operations in southeast British Columbia.

Industrial Minerals Location and Production

Industrial minerals encompass a wide range of substances used in agriculture, the natural resource sector, manufacturing and chemical processes. They are used to make products such as cement, cosmetics and pharmaceuticals, building supplies such as paint and plasterboard, fertilizer, and baking ingredients such as baking soda. Industrial minerals include building stones such as lime-

Energy and Mining

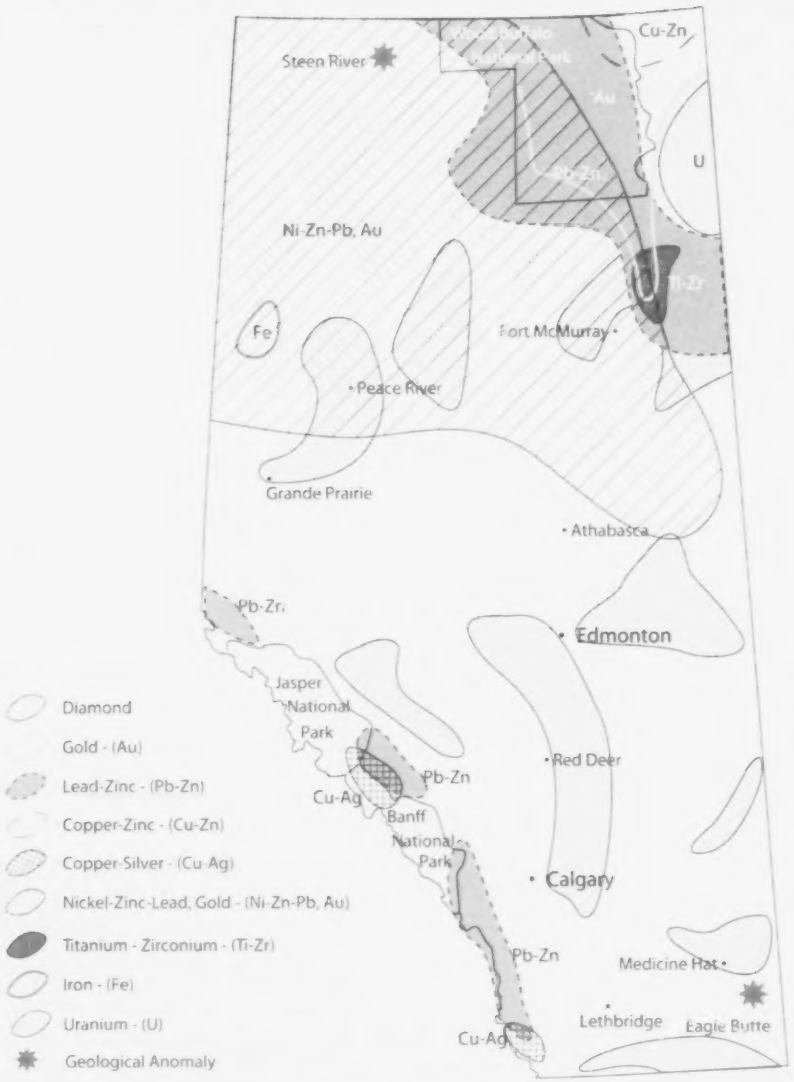


Figure 45. Location of Non-Energy Metallic Minerals

stone, sandstone and granite, and minerals such as gypsum, salt and sulphur. Alberta's limestone plants produce more than 2 million tonnes of cement each year. Small quantities of limestone rock are also quarried for use as building stone and in landscaping.

Gypsum is used worldwide in concrete for highways, bridges, buildings, and many other structures. It is also used extensively as a soil conditioner on large tracts of land in suburban areas, as well as in agricultural regions.

Salt, a residue of ancient seas covering parts of Alberta, is produced in significant quantities.[12]

Sulphur is a common by-product of oil sands and natural gas production in Alberta. This bright yellow powder is used in making fertilizers and other industrial products.

In 2005, Alberta's non-energy mineral production included sand and gravel, cement, elemental sulphur, salt, silica, and stone.

[12] Alberta Energy, Fact Sheet http://www.energy.gov.ab.ca/docs/minerals/pdfs/FactSheet_MineralFacts.pdf

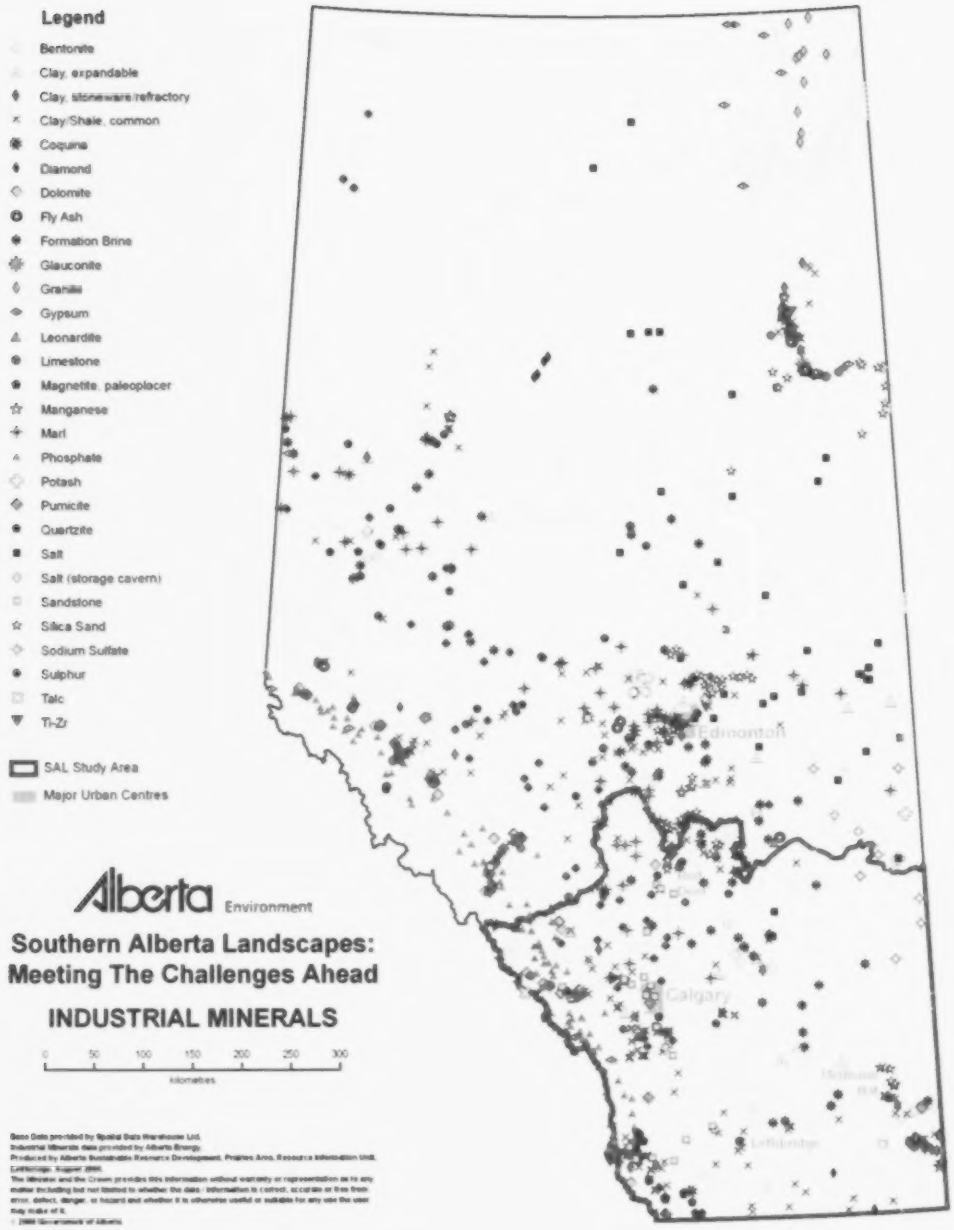


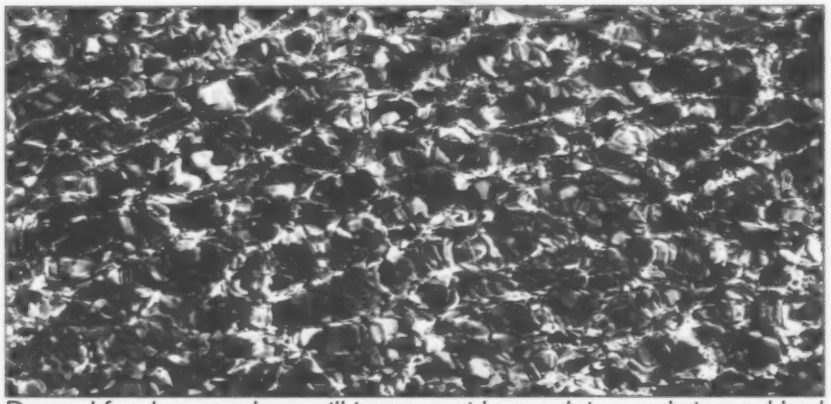
Figure 46. Non-Energy Industrial Minerals

Energy and Mining

Sand, Gravel and Other Aggregate Location and Production

The last glaciers deposited much of Alberta's sand and gravel. Natural sand and gravel aggregates and quarried rock are mainly used in cement making and construction aggregate for roads, buildings and other large structures. Gravels such as "Alberta rainbow rock" are also used for decorative purposes in landscaping.

Clay and shale are used to make bricks and other ceramic products. The swelling types of bentonite clay (sodium bentonite) are used for drilling mud in the oil and gas sector in Alberta.[13]



Demand for these products will increase with growth in population and land development, while supplies will be under pressure as existing reserves are depleted or become unavailable due to development of resource-bearing lands for other uses.

Alberta is the cement-manufacturing hub for the prairie provinces. There are two major plants, one near Exshaw in the SAL Region, and the other in Edmonton.

ENERGY AND MINERAL DEVELOPMENT IN THE SAL AREA

ENERGY DEVELOPMENT IN THE SAL REGION

In 2001, energy in the SAL area contributed just over $10 billion to the province's Gross Domestic Product (approximately 8% of Alberta's total GDP for 2001). Alberta is looking to maximize the recovery of remaining petroleum and natural gas reserves through improved recovery techniques and expanding into 'frontier' areas, such as the eastern slopes of the Rockies, and through the expansion of unconventional reserves.

As of February 2007, wind farms in southern Alberta had a wind generation capacity of 384 megawatts (MW) (provincial electricity generating capacity is 11,500 MW[14])[15]. Canada's installed wind energy capacity grew by 113% in 2006, so these figures change constantly.

Energy development occurs throughout the SAL study area, with the exception of the mountain parks. Current development in the study area includes:

- About 51,000 producing oil and gas wells,
- 184 sweet gas plants,
- 124 sour gas plants,
- About 116,860 km of pipelines,
- 1 active coal mine and one proposed,
- 1 coal-fired power plant (Sheerness) and one proposed,
- 1 gas-fired electrical generation utility,
- 4 gas fired non-utilities,
- 12 major petrochemical & chemical facilities,
- About 3,000 CBM wells,
- 21 wind-generated power projects, and
- 18 hydroelectric plants -11 plants in the Bow River Basin and 7 in the Oldman River Basin[16]

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[13] Alberta Energy, Fact Sheet http://www.energy.gov.ab.ca/docs/minerals/pdfs/FactSheet_MineralFacts.pdf, Additional Source: Alberta Geological Survey http://www.ags.gov.ab.ca/GIS/gis_and_mapping.shtml

[14] Alberta Department of Energy: http://www.energy.gov.ab.ca/537.asp

[15] Canadian Wind Energy Association, http://www.canwea.ca/production_stats.cfm The Alberta government signed contracts with Enmax and Canadian Hydro Developers to purchase 90% of its electricity requirements from green power starting in 2005. To meet their obligations, Enmax and TransAlta Wind (formerly Vision Quest) have constructed Canada's largest wind farm with 114 wind turbines with a total capacity of 75 MW at McBride Lake. Nearby Soderglen wind farm, with a total capacity of 70 MW, is now complete.

[16] Alberta Environment, Dams in the South Saskatchewan River Basin, http://www3.gov.ab.ca/env/water/regions/ssrb/pdf_phase2/ssrb%20Dams%20information%20sheet/pdf

Energy and Mining

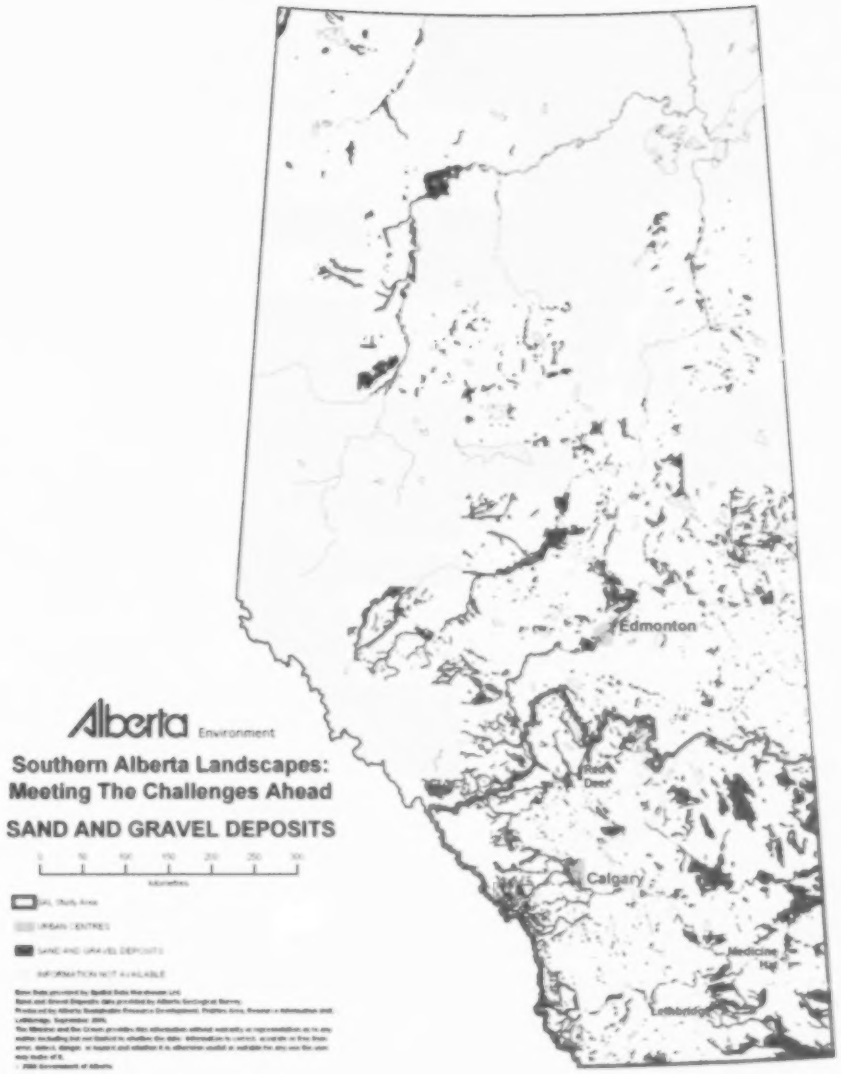


Figure 47. Sand and Gravel Deposits

Energy and Mining

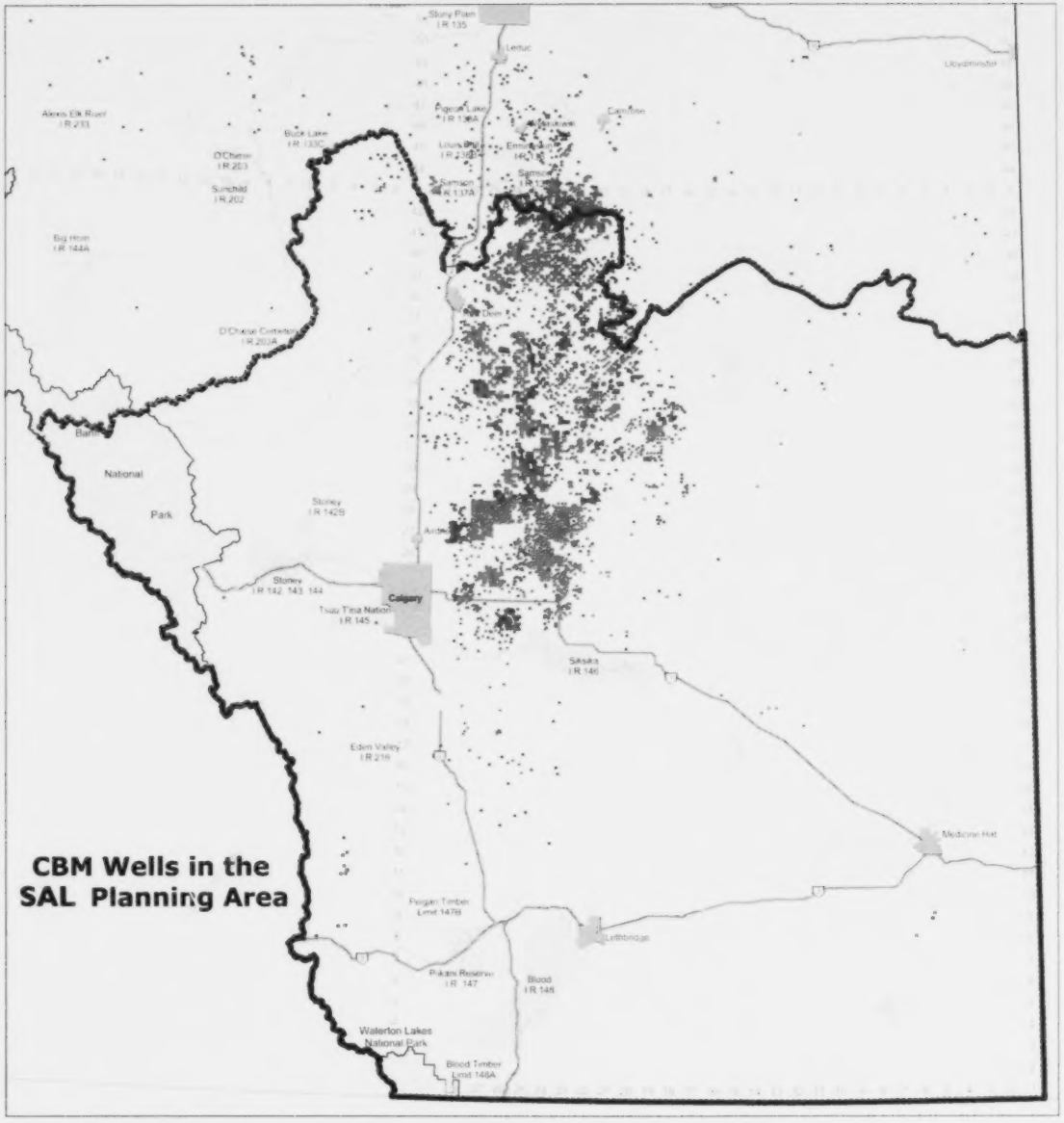
The 12 major petrochemical and chemical facilities produce a variety of products, including ammonia, methanol, ethylene glycol, alpha olefins, nitrogen/oxygen and ammonium nitrate. The NOVA Chemicals Joffre site produces ethylene and polyethylene. There is also an ethanol production plant near Red Deer and another has been proposed for an area south of Calgary.

NON-ENERGY MINERAL DEVELOPMENT IN THE SAL REGION

Current development of non-energy minerals within the SAL region includes:

- 29 metallic and industrial mineral permits, covering a total area of 161,869 hectares (ha),
- 61 mineral leases with a total area of 6,524 ha; 34 of the 61 mineral leases are for limestone,
- Proposal for a magnetite (iron) operation near the Crowsnest Pass,
- Lafarge cement plant near Exshaw,
- Lime plants near Coleman, Exshaw and the Crowsnest Pass,
- Brick plant near Medicine Hat,
- Ammonite factory in Calgary, (and ammonite mining along the St. Mary River)
- Gypsum, zeolite and barite facility in Lethbridge, and
- Aggregate mining in the Bow Corridor, west of Calgary.

Energy and Mining



Well Selection Criteria: Spud Profile

1. Data source EUB
2. Selected all wells with a licensed substance of: CBM & Oth or CBM coal
3. Selected all wells with a well status of: Flowing CBM & Oth, Flowing CBM Coal, Pumping CBM Coal, Susp CBM Coal, Testing CBM & Oth, Testing CBM Coal, and ABD CBM Coal Zn
4. Combine list 2 and 3 resulting in the final CBM NGC well list
5. Well counts are based on Surface hole location and not production events
6. These counts include "Active" and "Non Active" Wells
7. Wells spudded prior to 2000 are not included

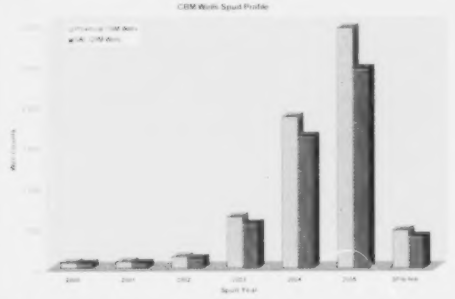
Spud Year	Provincial CBM Wells	SAL CBM Wells
2000	65	56
2001	73	59
2002	140	120
2003	623	544
2004	1,857	1,616
2005	2,949	2,450
2006 Feb	463	386
*Lic Locations	629	460

*Lic Locations - Proposed well locations

Well Selection Criteria: Active V.S. Non Active CBM wells

1. Data source EUB
2. Selected all wells with a licensed substance of: CBM & Oth or CBM coal
3. Selected all wells with a well status of: Flowing CBM & Oth, Flowing CBM Coal, Pumping CBM Coal, Susp CBM Coal, Testing CBM & Oth, Testing CBM Coal, and ABD CBM Coal Zn
4. Combine list 2 and 3 resulting in the final CBM NGC well list
5. Active Wells are wells that reported gas production in 2005/2006
6. Non Active wells are Disposal wells, Defect and Cancel, Abandoned Lic Locations or have not reported production in 2005/2006

Study Area	Active Wells	Non Active Wells	Total
Provincial Counts	4,514	2,713	7,227
SAL Counts	3,901	2,099	6,000



SAL Boundary

Active CBM Wells (Reported Gas Production 2005/2006)

Non Active CBM Wells

Base Features

National Park

Indian Reserve

Urban Area

Hydrography

Primary Highway

Figure 48. Coalbed Methane wells in the SAL Region

OIL AND GAS ACTIVITY

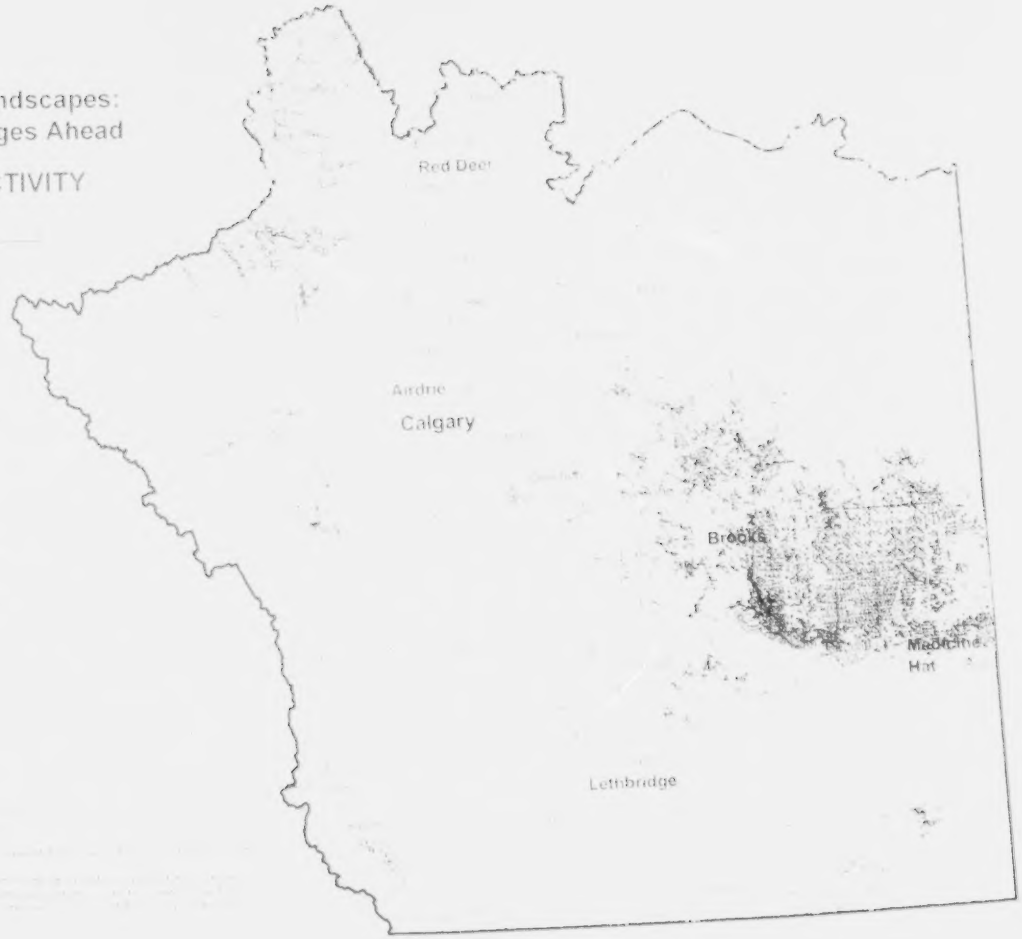


Figure 49 Oil and Gas Activity in the SAL Region

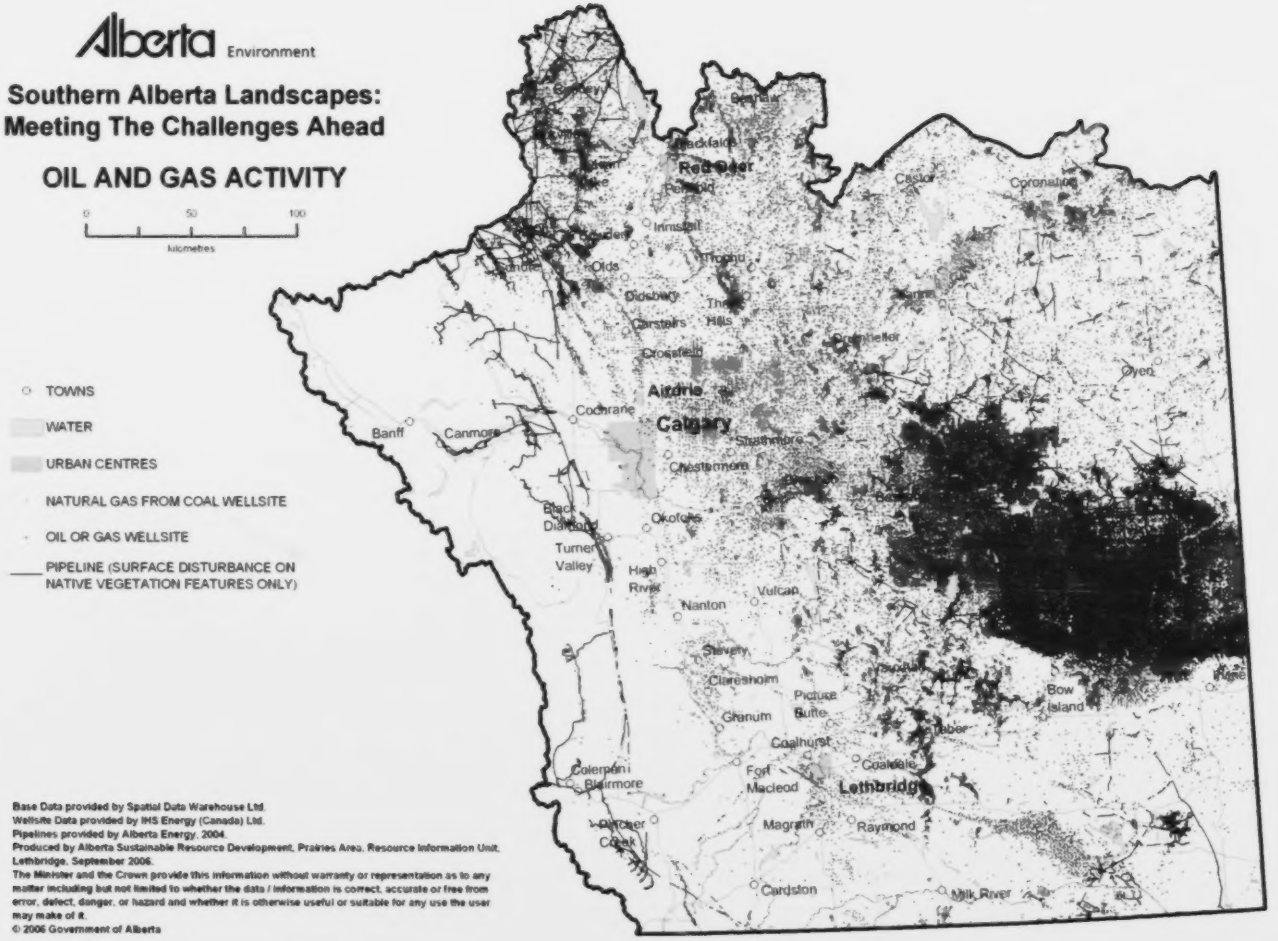
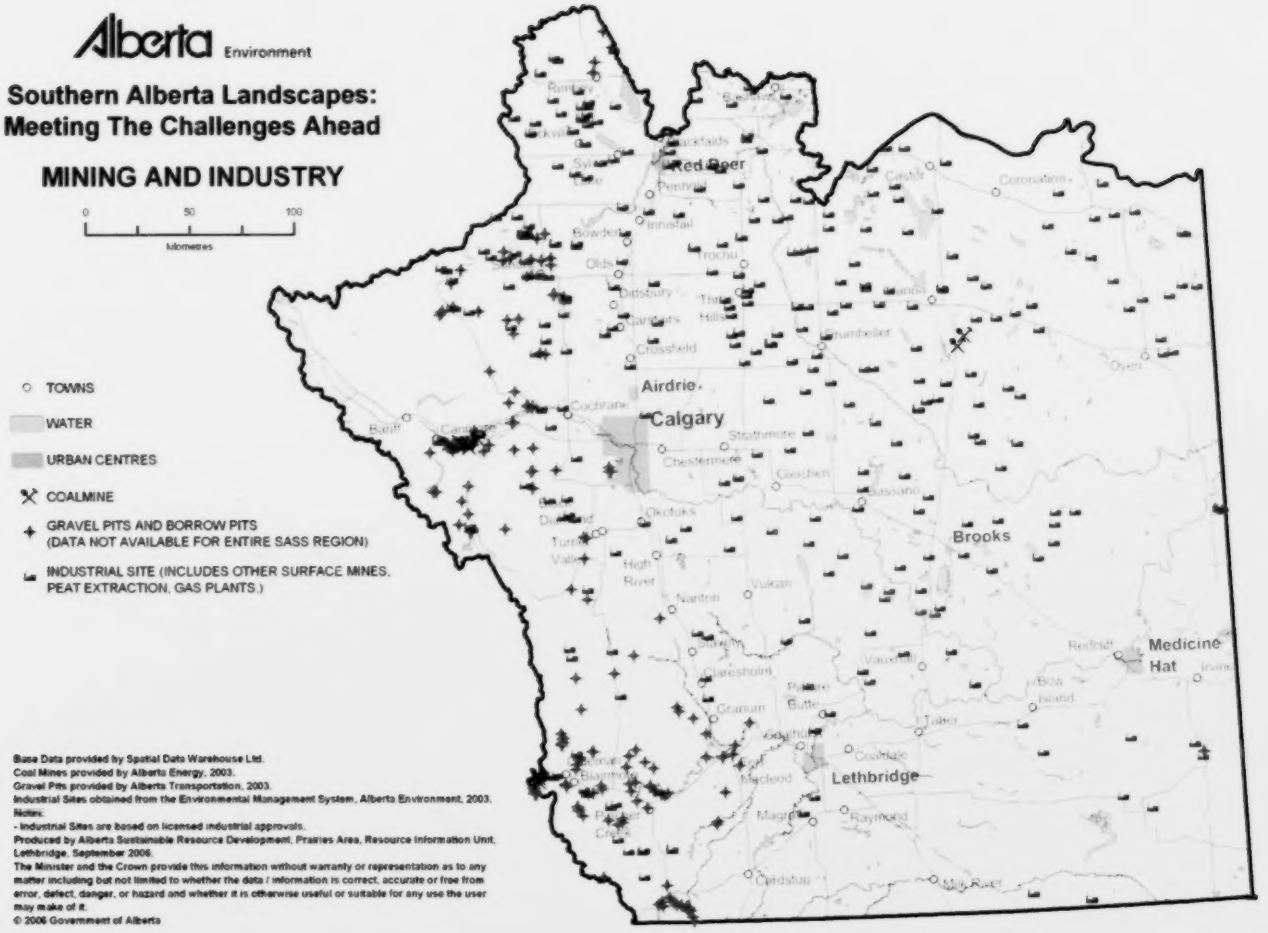


Figure 49. Oil and Gas Activity in the SAL Region

Figure 50. Mining and Industry in the SAL Region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Meeting The Challenges Ahead
MINING AND INDUSTRY
0
50
100
kilometres
TOWNS
WATER
URBAN CENTRES
COALMINE
GRAVEL PITS AND BORROW PITS
(DATA NOT AVAILABLE FOR ENTIRE SASS REGION)
INDUSTRIAL SITE (INCLUDES OTHER SURFACE MINES, PEAT EXTRACTION, GAS PLANTS.)
Base Data provided by Spatial Data Warehouse Ltd.
Coal Mines provided by Alberta Energy, 2003.
Gravel Pits provided by Alberta Transportation, 2003.
Industrial Sites obtained from the Environmental Management System, Alberta Environment, 2003.
Notes:
- Industrial Sites are based on licensed industrial approvals.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge, September 2006.
The Minister and the Crown provide this information without warranty or representation as to any matter including but not limited to whether the data / information is correct, accurate or free from error, defect, danger, or hazard and whether it is otherwise useful or suitable for any use the user may make of it.
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Calgary
Brooks
Medicine Hat
Lethbridge

Figure 50. Mining and Industry in the SAL Region

Forestry

Approximately 16% of the SAL region is classified as forest, including the closed forests of the foothills and mountains, in depressions, on steep, north-facing slopes, and along stream courses in the plains portion of the study area and in the Cypress Hills.

HISTORY

Management of the forests in southern Alberta evolved during the 20th century. Key events include:

- In 1930 the 'Transfer of Resources Act' established the Forests Division within the Department of Lands and Mines.
- In 1948 the Eastern Rockies Forest Conservation Board was established, ensuring watershed protection in the Crowsnest, Bow River and Clearwater Forests.
- The "Green Area", where most of the Eastern Slopes lies, was also established in 1948, giving policy direction for Eastern Slopes management.
- The Alberta Forest Service was established in 1953 to manage the province's forests.
- In 1955, North Western Pulp and Power Ltd. started Alberta's first pulp mill in Hinton.
- The quota tenure system was established in Alberta in 1966, via the Forests Act. A quota allocation is a legislated commitment of a percentage of the Annual Allowable Cut within a particular Forest Management Unit.
- During the late 1980s, through the 1990s and into 2001, a number of Forest Management Agreements were established throughout the province. Within Alberta, there are currently 20 Forest Management Agreements.
- From the 1970s through the 1990s, the Eastern Slopes Policy and Integrated Resource Planning were implemented. Allocation of forested land through a zoning system recognized activities sharing the same land base. This resulted in the separation, or exclusion, of land uses in areas of highest conflict (e.g., Prime Protection), and recognized that sometimes single or no use is appropriate.

CURRENT STATUS

The total volume of timber harvested from public land in Alberta increased from four million m^3 in 1970 to 20.3 million m^3 in 1995.[1] This does not include the additional harvest from private lands, which totalled more than three million m^3 in 1995. The total area harvested increased from 176 km^2 in 1970 to an estimated 560 km^2 in 1996, approximately 0.25% of the productive forested land base. The increase in harvest in recent years is due largely to the harvest of hardwoods, such as aspen, to manufacture wood pulp, paper and strandboard products. Despite the increase, the level of harvest from public owned lands remains below the current provincial Annual Allowable Cut of 22.1 million m^3.[2]

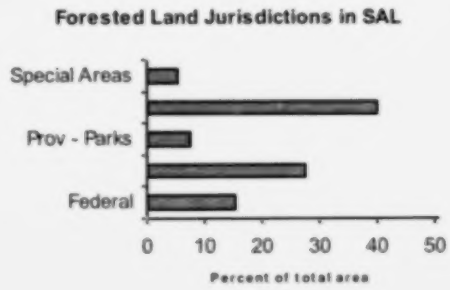


Figure 51. Forested Land Jurisdictions

A relatively small proportion (16%) of the SAL landscape is forested, and of that, only 48% is actively managed for timber. The provincial government, through Public Lands, Provincial Parks and Special Areas, manages most of this land production (see Figure 51). This includes management of the majority of the pine and spruce-fir forests. The federal government manages the largest proportion of white spruce, in Banff National Park. Freehold landowners manage significant portions of the remaining land base, including the greatest portions of cottonwood/riparian complexes and hardwood forests.

The remainder of the forested area is in parks, prime protection zone 1[3], or is withdrawn from the active land base because of proximity to water bodies, steep slopes and other limiting conditions.

[1] Canadian Forest Service 1997a

[2] Alberta's State of the Environment Report: Terrestrial Ecosystems

[3] Zone 1 is the Prime Protection Zone of the Eastern Slopes. It contains high-elevation forests and steep rocky slopes.

Forestry

Within the SAL project boundary there are:
2 Forest Management Agreements,
2 Community Timber Programs, and
4 Coniferous Timber Quotas.

As well, there are two primary forest product manufacturing facilities (sawmills) - Spray Lakes Sawmills Ltd. and its subsidiary, Crowsnest Forest Products Ltd. - and numerous smaller manufacturing facilities, including sawmills, round-wood processing facilities, log home manufacturers, and remanufacture plants.

CURRENT IMPACTS ON THE FOREST LANDSCAPE

Pressures and demands on the forest landscape are expected to grow as populations increase, and with them the demands for recreation and natural resources. Other impacts on the forest landscape include:

- Mountain Pine Beetle – current populations are on the increase in the Bow Corridor area. The last major epidemic was in the Crowsnest area in the early 1980's.
- Diseases – such as dwarf mistletoe, are prevalent in fire-origin lodgepole pine stands within the region.
- Access Management – off-highway vehicle use is steadily increasing and concomitant issues relating to watershed protection, vegetation and soil conservation, wildlife protection and user-conflicts are also increasing.
- Random Camping – garbage disposal, human waste disposal, fire prevention and protection (abandoned camp fires), rowdy behaviour, public safety, watershed protection, wildlife protection, and vegetation damage are among the issues that are less controlled in random camping than in designated camping sites.
- Community Protection – protection of forest communities and adjacent developments from the threat of wildfires. More housing developments are being built within forest environments, where wildland/urban interface fires are a threat.
- Cattle grazing and riparian management.
- Landbase maintenance – including losses and fragmentation due to other developments, such as oil and gas.
- Wildlife habitat maintenance.

GRAZING DISPOSITIONS

Grazing dispositions occur on more than six million acres of public land in Alberta. An additional 8100 km^2 of land in the Rocky Mountains Forest Reserve is designated for grazing use through allotments. Public land provides over 1.6 million Animal Unit Months (see Glossary) of forage each summer to about 14% of all Alberta's beef cattle. Grazing leases, which account for most of the public land grazing, are long-term authorizations to individuals, corporations or associations. Lease size ranges from an average of less than a section 2.6km^2 in central Alberta to almost three sections 7.8km^2 in the southern Alberta grasslands. Grazing allotments are large areas of forested range in the central and southern foothills of the Rocky Mountains. They have minimal fencing, are defined by natural barriers such as rivers and mountain ranges, and cattle only graze a small portion in any given summer.[4]

[4] Alberta Sustainable Resource Development http://www3.gov.ab.ca/srd/land/APL_Grazing_Stats.html

Tourism, Parks and Recreation

Alberta is legendary for its natural wonders, including the Canadian Rockies, pristine rivers, badlands, world-renowned dinosaur digs, abundant wildlife, golden prairies, grassy foothills, rugged wilderness, and a unique aboriginal heritage.

Alberta is Canada's fourth most popular tourist destination and is internationally recognized for its diverse, high quality tourism products, resorts and experiences. Four of Canada's 13 UNESCO World Heritage Sites – the Canadian Rocky Mountain Parks (including Banff National Park) Dinosaur Provincial Park, the Head-Smashed-In Buffalo Jump complex, and Waterton-Glacier International Peace Park - are in the SAL area. Tourism revenues are evenly distributed throughout the province with Edmonton and area, Calgary and area, Canadian Rockies and the remainder of the province each representing about one quarter of the total revenues.[1]

This section looks at Parks and Protected Areas in the SAL region, and the tourism and recreation facilities both within and outside those areas.

PARKS AND PROTECTED AREAS

HISTORY AND DEVELOPMENT

Southern Alberta is the birthplace of Canada's system of National Parks. Banff, Alberta was Canada's first national park, established in 1885. Waterton Lakes was designated Canada's fourth national park in 1895.

The earliest provincial parks were established by Order-In-Council in 1932. Although Cypress Hills was not formally established as a provincial park until 1951, Elkwater Lake in the Cypress Hills area was included in the capital budget for parks in 1929.

Early parks in the SAL region were small recreation sites. These provided local residents with nearby scenic spots to swim and picnic. Similar recreation sites were developed by other agencies. Wayside campsites were built along the highways to serve the motoring public. Most of these have been closed and replaced by municipal parks.

Recreation areas were often created in response to environmental concerns. Forest recreation areas were constructed in the mountains and foothills to control litter, localize impacts and minimize the risk of forest fires created by random camping. Campsites and picnic areas built on the irrigation reservoirs provided recreational access to the water and helped control shoreline erosion.

Other sites were preserved for their archaeological significance. Writing-On-Stone was reserved for park purposes in 1935, in recognition of the petroglyphs and pictographs for which it is now famous. Dinosaur Provincial Park, first opened to the public in 1959, was recognized as a World Heritage Site in 1979, the first site under a provincial level of jurisdiction to receive this international designation.

Kananaskis Country, established in 1977, was the first initiative in the province to integrate preservation, outdoor recreation, heritage appreciation and tourism, the four goals of the parks and protected areas program.

[1] Strategic Tourism Marketing Council http://www.industry.travelalberta.com/strategicplan/overview/index.cfm

CURRENT STATUS

Today, the parks and protected places network in southern Alberta includes a spectrum of areas ranging from intensively developed recreation sites to pure wilderness. These areas preserve natural landscapes, ecological processes and associated biological diversity. As well, they provide opportunities for heritage appreciation, outdoor recreation and heritage tourism.

Parks and protected areas account for 7.2% of the land base, or 10,011 km^2 of the SAL region, compared with 12.4% for Alberta as a whole. Almost seven million visitors come to the 206 parks and protected areas in the SAL region annually. About 80% of visitation to the provincial network is to sites in southern Alberta, and 40% of total provincial park visitation is to Kananaskis Country, with 36% to Fish Creek, Aspen Beach, Sylvan Lake, Jarvis Bay, Cypress Hills, Midland, and Dinosaur Provincial Parks.

Major tourism programs are offered in Cypress Hills Provincial Park, Dinosaur Provincial Park, and Peter Lougheed Provincial Park. There are staffed interpretive programs in Beauvais Lakes Provincial Park, Bow Valley Provincial Park, Chain Lakes Provincial Park, Writing-On-Stone Provincial Park, and in Kananaskis Country. Similar programs are provided in Banff and Waterton Lakes National Parks. Midland Provincial Park at Drumheller is the site of the Royal Tyrell Museum of Palaeontology, regarded by many as the best dinosaur museum in the world.

Figure 52 shows the number of sites in each type of park and protected area in the SAL region and the area (in km^2) they occupy.

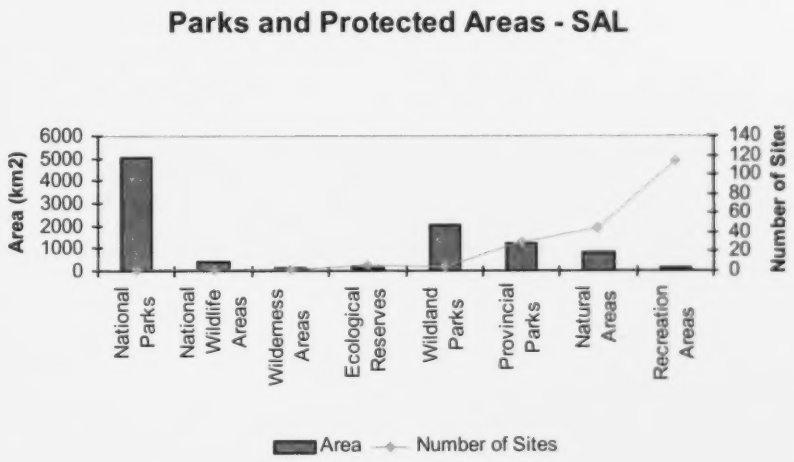
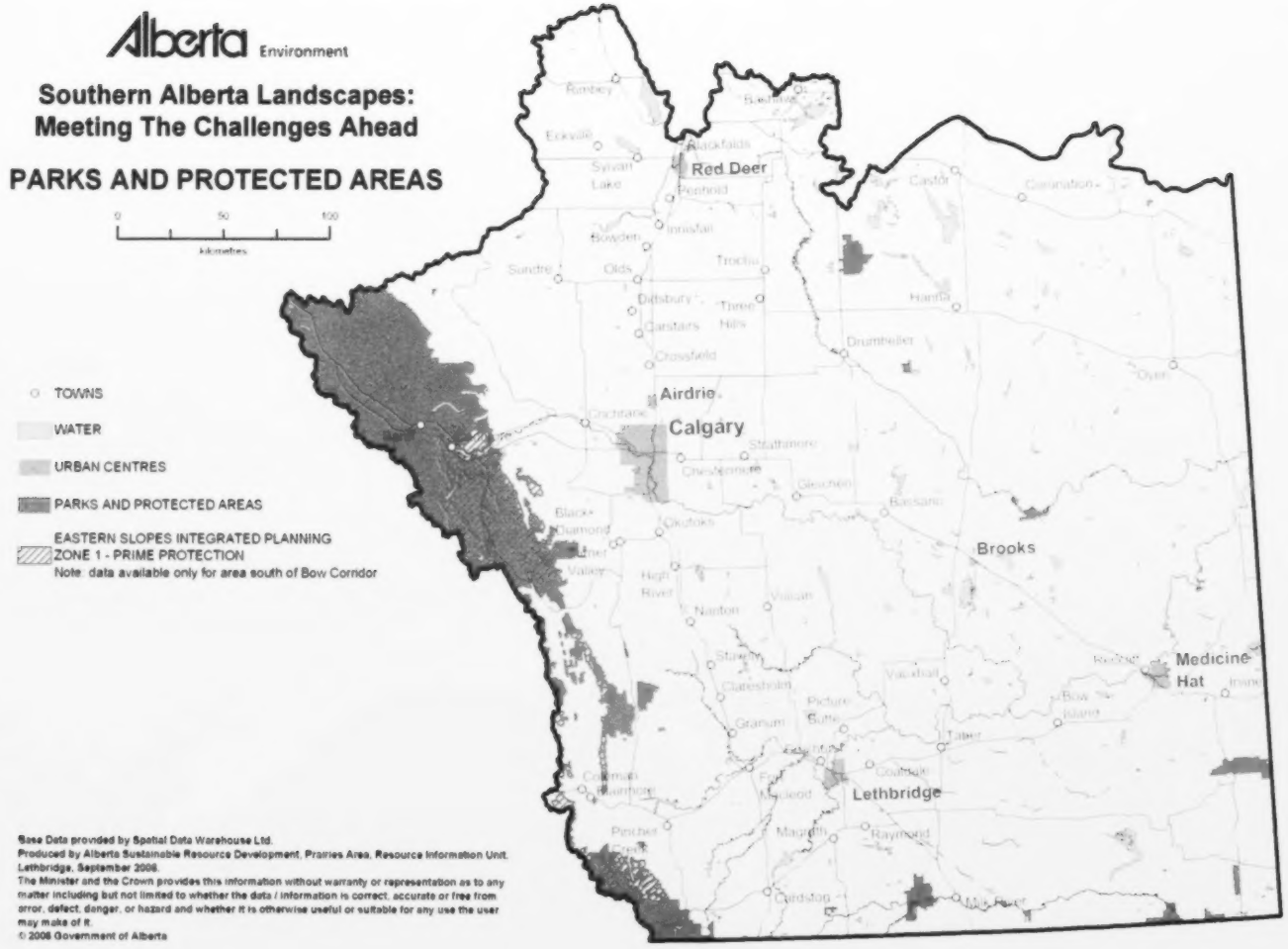


Figure 52. SAL Region Parks and Protected Areas

Figure 53 shows the parks and protected areas in the SAL region, including the Eastern Slopes Integrated Planning Zone 1: Prime Protection Area, south of the Bow Corridor.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PARKS AND PROTECTED AREAS
0
50
100
kilometres
TOWNS
WATER
URBAN CENTRES
PARKS AND PROTECTED AREAS
EASTERN SLOPES INTEGRATED PLANNING ZONE 1 - PRIME PROTECTION
Note: data available only for area south of Bow Corridor
Base Data provided by Spatial Data Warehouse Ltd.
Produced by Alberta Sustainable Resource Development, Prairies Area, Resource Information Unit, Lethbridge, September 2006.
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Figure 53. Parks and Protected Areas SAL Region

TOURISM AND OUTDOOR RECREATION FACILITIES

Figure 54 shows the number of campsite nights occupied in each of the Parkland, Prairie and Southern East Slopes geographical areas of the SAL region (excluding the national parks), for the years 1987 through 2000. Not surprisingly, the number of campsite nights is significantly higher in the Southern East Slopes, as this is foothills and mountain country and a popular area for campers. It is interesting to note how stable the numbers have remained during the years since 1987-88.

Figure 55 shows the locations of ski areas, golf courses and campgrounds in the SAL region.

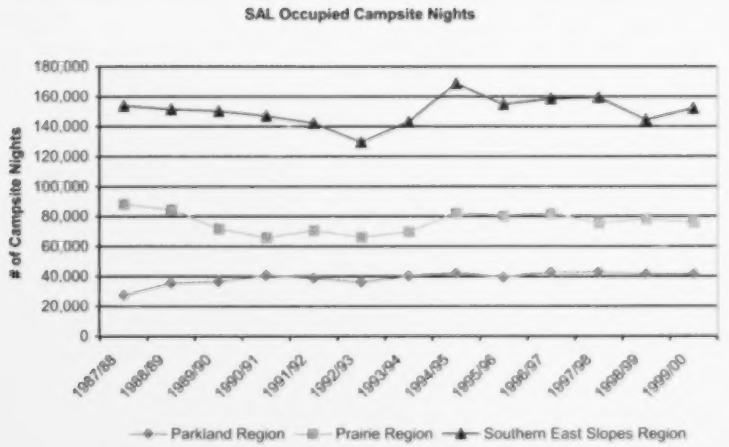
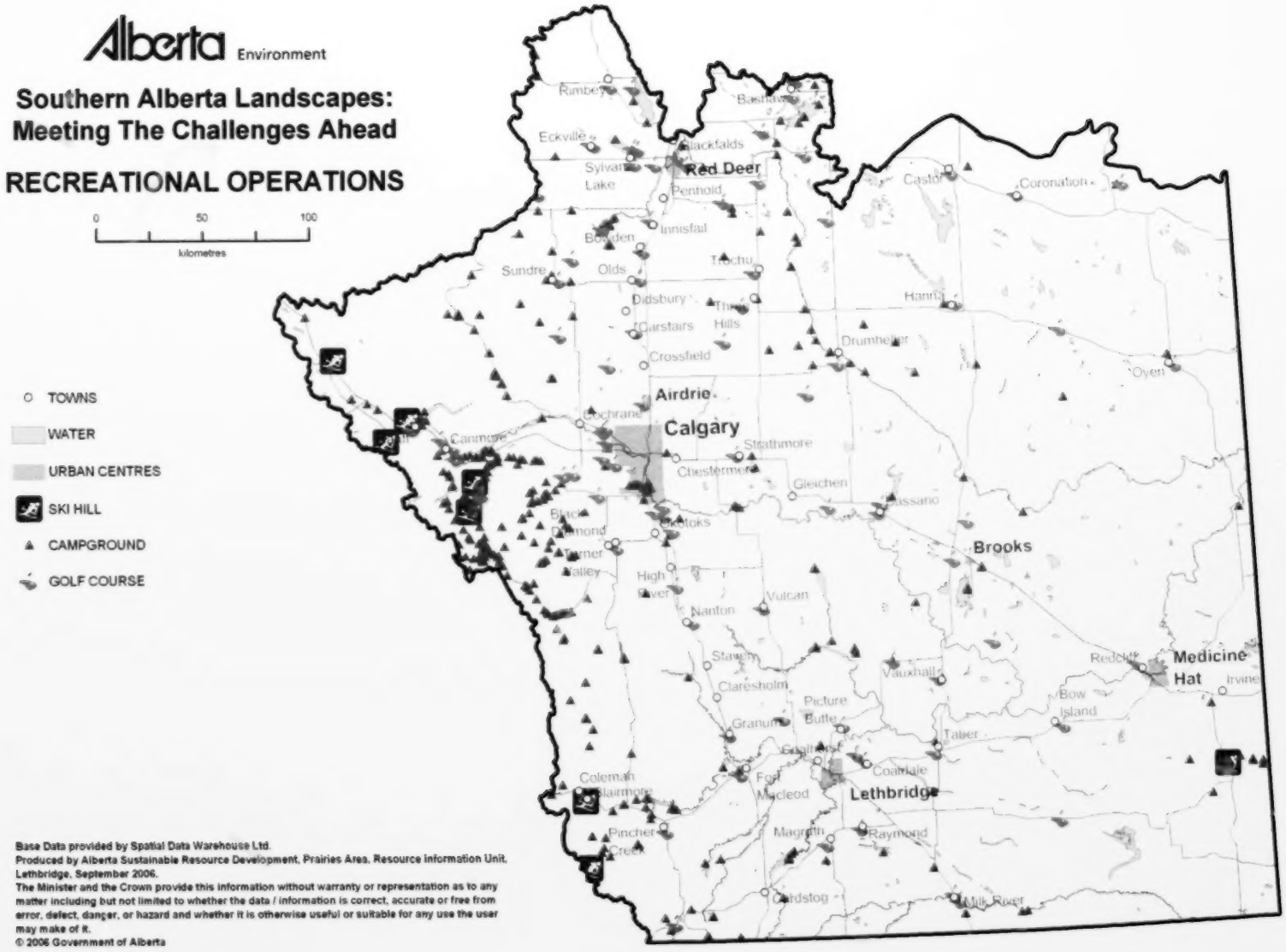


Figure 54. SAL Occupied Provincial Campsite Nights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RECREATIONAL OPERATIONS
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kilometres
TOWNS
WATER
URBAN CENTRES
SKI HILL
CAMPGROUND
GOLF COURSE
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Lethbridge
Base Data provided by Spatial Data Warehouse Ltd.
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Figure 55. SAL Region Recreational Operations

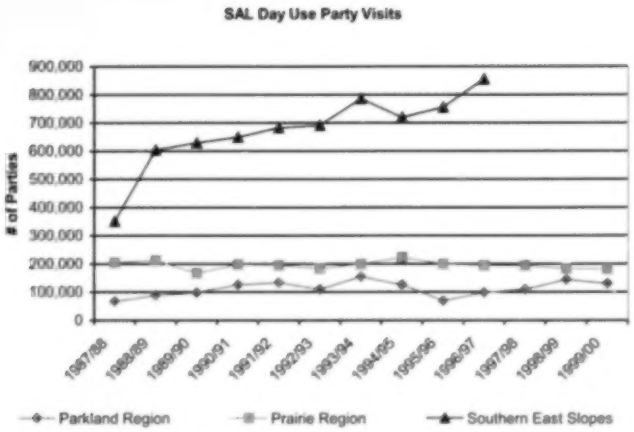

Figure 56. SAL Day Use Party Visits

Figure 56 shows the number of parties using provincial recreational facilities in the SAL region during the day. Again, numbers in the Southern East Slopes region are significantly higher than in the Parkland and Prairie regions, and in this case show a significant increase in numbers of parties, from about 310,000 in 1987/88 to about 850,000 by 1998/99.

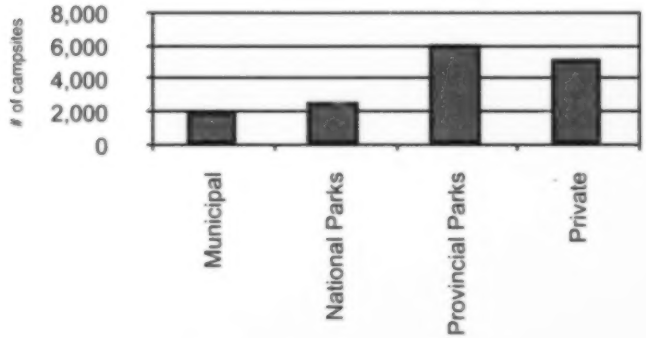

Figure 57. Campsite Ownership in SAL Region

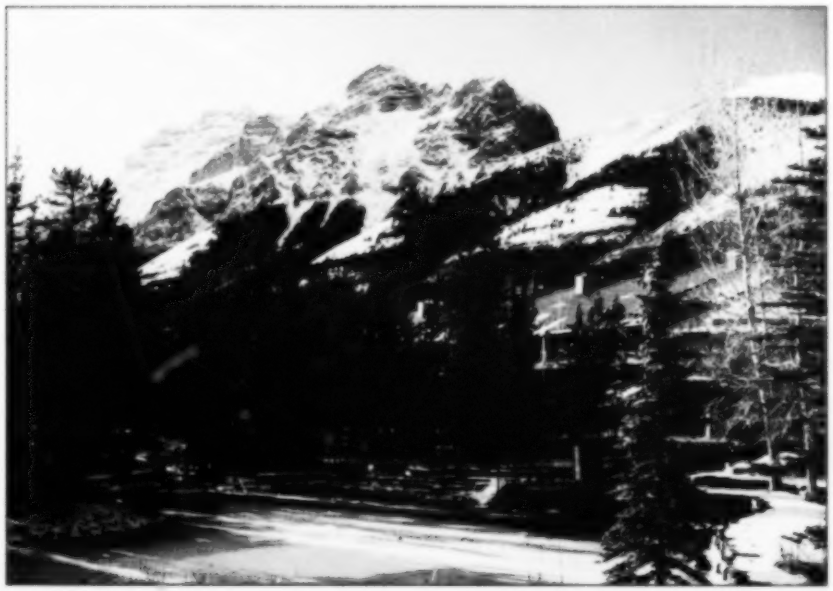

Figure 57 compares campsite ownership in the SAL region. In total, there are 182 campgrounds and 16,000 campsites, covering an area of 4,830 km^2.

Skiing is a growing industry in the SAL region due to easy access to the Rocky Mountains and the Eastern Slopes. There are 12 major ski areas – Fortress Mountain, Nakiska, Canyon, Drumheller, Hidden Valley, Pass Powderkeg, Wintergreen, Canada Olympic Park, Castle Mountain, Sunshine Village, Lake Louise, and Mount Norquay – with a total of 4012 hectares on which people can ski.

Golf is another tourism growth industry in the SAL region, with 91 golf courses currently operating. Together they offer 1,250 holes and cover an area of approximately 4,400 hectares.

Summary

The anthropogenic and natural features of the southern Alberta landscape are intricately connected to form a jigsaw puzzle of many overlapping pieces and layers.

The natural landscape of Grasslands, Parkland, Foothills, Rocky Mountains, and Boreal Forest, once home to relatively small populations of First Nations people and vast populations of bison and other plants and animals, now show the footprint of farming and ranching, oil and gas development, rural settlements and urban cities, tourism and forestry.

The waterways of the South Saskatchewan, Battle and Milk River Basins, fed by glaciers, snow and rainfall, were carved from the landscape during thousands of years. Today, water from the rivers serves multiple purposes: irrigation agriculture, mining, industry, and human consumption, not to mention preservation of the riparian ecosystem. Dams and diversions on southern Alberta rivers have made it possible to achieve a high standard of living in the region, yet with 80% of the province's population having access to just 20% of the water, southern Albertans are recognizing that this precious resource has its limits.

While the SAL region has a relatively small human population – about 1.5 million persons, or on average 13 people per km2 – the impacts on the landscape of that population and their endeavours are having a significant impact on native plants and animals. The SAL region landscape is currently about equally split between natural landscapes and cropland. Roads, railways, oil and gas activity, agriculture and urban growth all have an effect on wildlife. Birds such as burrowing owls, loggerhead shrikes, piping plovers and Sprague's pipits have been designated species at risk due to the effects of pesticides, cultivation, and loss of food sources and habitat. Grizzly bears, which require huge tracts of land for their range, are dwindling in numbers, and swift foxes have been all but eradicated in southern Alberta. The northern leopard frog has been affected by the introduction of invasive plants and animals and the prairie rattlesnake populations are known to have declined in recent years.

On the other hand, tourists from around the world are attracted to the parks and protected areas in the SAL region, both provincial and national, because of their scenic beauty and the natural assets of the region. Four of Canada's 13 UNESCO World Heritage Sites are in the SAL region, and people come to hike, camp, golf and ski. Access roads and railways make these places readily accessible.

Forestry is a relatively small industry in the SAL region, with only about 16% of the region classified as forest. But forests also attract people, and there is significant population growth occurring on the Eastern Slopes of the Rockies, particularly just west of Calgary. Calgary itself is growing by about 17,000 people a year, and the other four cities in the region, Red Deer, Airdrie, Lethbridge, and Medicine Hat, show continuing growth that is not expected to stop any time soon.

Southern Alberta's landscapes have provided its people with beauty, resources and opportunities to have a high standard of living while protecting these environmental gifts. With the cumulative effects of increasing development on these landscapes, it will be up to southern Albertans to work together to determine the strategic, regional outcomes we want for the present and future of this richly diverse part of the world, and the means by which we will achieve them.

Glossary

Glossary of Terms as Used in the State of the Landscape Report

A

Airshed:[8] A geographic area that, because of emissions, topography and meteorology, typically experiences similar air quality.

Allocation (water):[2] The volume, rate and timing of a diversion of water. When water is redirected for a use other than for household purposes (use by an owner of property adjacent to a water body or from an aquifer), it is referred to as an allocation. All water users (except for household users) apply to Alberta Environment for a licence to use a set allocation of water.

Animal Units: Calculating livestock production on the basis of animal units (AU) rather than numbers of animals allows better comparisons in terms of feed and grazing land needed and manure production. One AU is defined as a 1000 lb. (450 kg) beef cow, with or without a nursing calf. A mature bull is the equivalent of 1.3 AU; a yearling steer or heifer is 0.67 AU and a weaned calf is 0.5 AU. An AU is calculated by multiplying the number of animals by the appropriate AU factor for the specific type of animal.

Animal Unit Months (AUMs): The amount of forage required by one animal unit (AU) for one month. An AUM is calculated by multiplying the AU for a particular animal by the number of days in the month.

Anthropogenic: Caused or influenced by human activities.

Anthropogenic Edge: The boundary between disturbed or developed land and natural habitat. The juxtaposition of the human landscape affects the natural environment for some distance from the edge. The resultant edge can alter the temperature, light intensity, plant and animal migration patterns and other aspects of the natural ecosystem.

Anthropogenic Footprint: A measurement of the land physically influenced by people; associated primarily with emerging transportation networks, cities and towns, rural residences and cropland, recreational developments and acreages, well sites, pipelines, and acreages.

Apportionment, Master Agreement:[2] Schedule A of the 1969 Master Agreement on Apportionment for the South Saskatchewan River between Alberta and Saskatchewan allows Alberta to "divert, store or consume" from the river system each year, a volume of water equal to one-half of the apportionable flow of the South Saskatchewan River at the Alberta-Saskatchewan boundary. The remaining volume of flow must be allowed to pass downstream into Saskatchewan. The exception to this general rule is that Alberta is entitled to divert, store or consume a minimum of 2.1 million acre-feet in any year. The effect of this exception is that during years when the volume of natural flow is less than 4.2 million acre-feet (a rare occurrence), Alberta may pass less than one-half of the apportionable flow to Saskatchewan. If at any time during a year Alberta wants to divert, store or consume more than half the apportionable flow, a flow rate of 1500 cubic feet per second (cfs) must be maintained at the Saskatchewan border, unless the natural flow is less than 3000 cfs, in which case half the natural flow must be passed. There is no policy in Alberta concerning the amount of water each sub-basin of the South Saskatchewan River Basin must contribute to the Saskatchewan apportionment.

Approval:[1] A permit issued to operate municipal facilities and industries.

Aquatic Environment:[2] (As defined in Alberta's Water Act) The components of the earth related to, living in or located in or on water or the beds or shores of a water body, including but not limited to all organic and inorganic matter, and living organisms and their habitat, including fish habitat, and their interacting natural systems.

B

Barrel: Crude petroleum and the refined products made from crude oil are measured either by volume, in cubic metres, gallons or US barrels, or by weight, in tonnes or tons. The loose rule of thumb for conversion is that a barrel a day is roughly 50 tonnes a year, but the relationship varies according to density and product. One US barrel is considered the equivalent of 0.15899 cubic metres (1 m3 = approximately 6.29 barrels.)

Basin:[1] A geographic area drained by a single major river, including its tributaries, lakes and other water bodies. Same as watershed. (Also see river basin.)

BAC / Basin Advisory Committee:[2] A group established in river basins and sub-basins to provide advice for water management planning. Members of the BACs represent all sectors interested in water management in the sub-basin. Typical sectors represented in a BAC include irrigation agriculture, non-irrigation agriculture, ecosystem protection/environmental, First Nations, industry, municipal, and recreation.

Best Management Practices (BMPs): 8 Management practices or techniques recognized to be the most effective and practical means for meeting goals, while minimizing adverse environmental and other effects. Also called Beneficial Management Practices.

Biodiversity:[1] Variety of life forms and processes (including species, communities and gene pools) in an environment. (Or the number of different types of living organisms, including bacteria, animals and plants, within an ecosystem.)

C

Carbon Dioxide Sequestration (Carbon Sequestration): Carbon dioxide sequestration is a process by which carbon dioxide is removed from the atmosphere and stored indefinitely, in order to reduce the build-up of this principal greenhouse gas in the atmosphere and slow down the process of global warming. This may be done by increasing biomass (planting trees and grasses), by changing farming practices, by injecting it underground, or by increasing phytoplankton growth in the oceans.

Census Division:[5] A group of neighbouring municipalities joined together for the purposes of regional planning and managing common services (such as police or ambulance services). These groupings are established under laws in effect in certain provinces and territories of Canada.

Climate:[1] A combination of all elements that characterize the atmosphere, especially those related to weather; a generalized statement or average of prevailing weather conditions.

Climate Change:[1] A long-term change in the average weather of a region.

Conservation: The careful utilization of a natural resource in order to prevent depletion.

Contaminant:[1] A substance in water, air or soils that is not normally present. Usually used for substances of concern for aquatic or human health, although it may include naturally occurring substances.

D

E

Ecological Footprint:[8] An indicator of the magnitude, duration, frequency and distribution of environmental stressors and natural resource consumption associated with an activity.

Ecology:[1] The study of the inter-relationships among living things and their environment.

Ecoregion:[1] A contiguous geographic area with similar environmental conditions and therefore, similar plants and animals.

Ecosystem:[1] A community of animals, plants and bacteria and their interactions with each other and with their chemical and physical environment.

Edge Effects: See Anthropogenic Edge

Effluent:[1] Wastewater discharged to a stream, usually from a pipe.

Endangered Species: A species in danger of extinction from its entire natural range.

Environmental Effects:[1] Harmful effects on the environment from human activities.

Environmental Goods and Services:[8] (i) Goods and services that are used, or can potentially be used, to measure, prevent, limit or correct environmental damage (both natural or by human activity) to water, air, soil, as well as problems related to waste, noise and ecosystems. This includes technologies used to reduce resource use, energy, emissions and waste. Critical to the definition is the end-use of the goods and services for environmental purposes.

(ii) Those products, often called public goods, which have environmental benefits but have no value in the traditional marketplace. Therefore they provide no direct economic return for producers. Examples include clean air, clean water, water supply, carbon storage, biodiversity, healthy soils and scenic vistas.

Environmental Quality:[8] A measure of the status of the environment, overall or in relation to a medium such as air, water, or land, or to the needs of its inhabitants.

Ethane: A colourless, odourless gas (C_2H_6) produced chiefly from natural gas and as a byproduct of petroleum refining. Its chief use is as petrochemical feedstock for ethylene production. Most ethane production is to exact industry specifications, (to differentiate it from butane and propane,) hence is called specification ethane.

Extirpated Species: A species that no longer exists in a given part of its natural range, but still exists in other areas.

F

Footprint: A measure of how much land and water an individual, city, region, or humanity as a whole requires to produce the resources it uses and to absorb all the waste it generates, using prevailing technologies.

Fragmentation: The process of reducing the size and connectivity of an ecoregion or habitat. The resulting reduction in the total habitat area, the isolation of patches of habitat from each other and the increase in edge effects can affect the ability of organisms to maintain healthy populations and to survive.

G

Green Area:[3] The unsettled portion of the province, primarily forest lands not available for agricultural development other than grazing.

Glossary

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Greenhouse Gas Emissions:[4] The release of greenhouse gases from the combustion of fossil fuels used for energy production. These emissions can affect climate and introduce pollutants that impact on air quality.

Greenhouse Gases: Gases, such as carbon dioxide or methane, which can contribute to climate change.

H

Habitat: The sum of the environmental conditions in which an organism lives, or the physical and biological environment that provides essential food, water and shelter for an organism.

I

Instream Flow:[2] The rate of flow in a river, without reference to its purpose.

Instream Flow Needs (IFN):[2] This is the scientifically determined water quantity or level, flow rate, and water quality required in a river or other body of water to sustain a healthy aquatic environment and to meet human needs such as recreation, navigation, waste assimilation or aesthetics.

Invasive (and Alien) Species: Alien species are defined as species of plants, animals and micro-organisms introduced outside their natural past or present distribution. Alien species become invasive when they establish and spread in the new environment and threaten the native species, the environment, the economy, or some aspect of society. Alien species are also known as exotics, non-indigenous species, non-native species, or foreign species. They are sometimes called weeds or pests.

Irrigation District:[2] An organization that owns and manages a water delivery system for irrigation for a given region. In Alberta, there are 13 irrigation districts, all within the SAL region. Some irrigation districts convey water for other purposes, such as municipal use and stockwatering.

J, K

L

Land:[4] Land refers to soil, surface water, groundwater and natural habitats. Impacts to land include the adverse effects on the environment that may occur from construction activities, agricultural activities, development of the urban environment, and contamination.

M

Model:[1] A computer program used to describe and make predictions about natural events.

Multiple Use: Management of a land area to support integrated use including timber and non-timber interests such as water, grazing, industrial development, recreation and wildlife.

N

Natural Capital:[8] The value and utility of natural assets that is critical to our economic prosperity and quality of life. Like other forms of capital, natural assets require careful stewardship and investment for their value to grow and pay dividends over the long-term.

Natural capital consists of three components:

- Natural resource capital – stocks of renewable and non-renewable resources (e.g., minerals and energy, forests, water, fisheries)
- Ecosystems or environmental capital – systems that provide essential environmental goods and services such as our atmosphere and the waste assimilation provided by wetlands; and
- Land – the space in which human activities take place.

Natural Flow: [2] Natural flow is the flow in rivers that would have occurred in the absence of any man-made effects or regulation of flow. For purposes of water management, natural flow is a calculated value based on the recorded flows of contributing rivers, a number of factors concerning the river reaches (e.g. evaporation, channel losses, etc.) and water diversions. This is also known as "reconstructed flow" and "naturalized flow".

Natural Region:[6] A group of contiguous landscapes that contain similar landforms, hydrology, geology, soils, climate, plants and wildlife.

Non-point Source: A diffuse source of water pollution that does not discharge through a pipe or other specific source; as contrasted with a point source.

Nutrient:[1] A substance essential for the growth of living organisms. In water, it usually refers to nitrogen and phosphorus, the same chemicals used to make a garden grow.

O

Oil Sands: Deposits of bitumen, a molasses-like oil that is extracted through drilling and the use of steam heat. They are contained in sand deposits beneath 140,800 km2 of northeast Alberta. Less than 3% of the initial established resource has been extracted to date.

P

Partner:[8] An individual or organization that shares the costs, risks, benefits, power, and/or resources necessary to achieve a common objective. Partners resolve problems through mutual agreement.

Partnership:[8] A relationship in which individuals or organizations share resources and responsibility to achieve a common objective, as well as share any resulting rewards or recognition. It often includes a formal contract, new resources and shared risks and rewards. The structure includes a central body of decision-makers whose roles are defined. The links are formalized. Communication is frequent, the leadership is autonomous and the focus is on specific issues. There is group decision-making in central and task groups. Partnerships are a form of collaboration.

Pesticides: Chemical compounds used to destroy unwanted species, including herbicides, insecticides, fungicides, and rodenticides.

Petajoule: A measure of energy equivalent to 1 million gigajoules (1,000,000,000,000,000 joules) or approximately 30 million kilowatt hours.

Pollution:[1] The contribution of substances from human activities that may make the environment less suitable for desired uses.

Protected Areas: Areas such as provincial parks, federal parks, wilderness areas, ecological reserves, and some recreation areas that have protected designations according to federal and provincial statutes. Protected areas are land and freshwater or marine areas set aside to protect diverse natural and cultural heritage.

Public Awareness:[8] This refers to information sessions, web postings for information, social marketing, advertising and promotion of information, attitudes, values and behaviours to create a climate conducive to social and behavioural change.

R

Reclamation:[1] The process of converting disturbed land to its former uses and productivity. Similar to restoration, which is a more general term defining the process of returning any site to a prior condition.

Resources:[4] Anything that is of use to humankind.

Resources, Non-renewable:[4] Substances which have built up over geological time and can only be replaced over geological time. Non-renewable resources can be managed sustainably if the use rate does not exceed the rate at which they can be substituted with comparable renewable resources, and if critical natural capital is not eroded.

Resources, Renewable: Natural substances that are depleted at a rate slower than the rate at which they regenerate. Renewable resources include oxygen, fresh water, and timber. However, even these resources can become non-renewable if used at a greater rate that the environment's capacity to replenish them. For example, groundwater may be removed from an aquifer at a rate greater than the sustainable recharge.

Riparian Area:[2] The area along streams, lakes, and wetlands where water and land interact. These areas support plants and animals, and protect aquatic ecosystems by filtering out sediments and nutrients originating from upland areas.

River Basin:[2] An area of land drained by a river and its associated streams or tributaries. Alberta's Water Act identifies seven major river basins within the province:

- Peace/Slave River Basin
- Athabasca River Basin
- North Saskatchewan River Basin
- South Saskatchewan River Basin
- Milk River Basin
- Beaver River Basin
- Hay River Basin

Runoff:[1] Water that moves across land or through soils during snowmelt or rainstorms.

S

Sediments:[1] Soil particles that have been transported from their original location by wind or water. They may be in suspension or have settled to the bottom of a stream, lake or delta.

South Saskatchewan River Basin (SSRB):[2] The SSRB includes the sub-basins of the Red Deer River, Bow River, and Oldman River (including the South Saskatchewan).

Species at Risk:[7] Plants or animals being extirpated, endangered, threatened, or of special concern.

Stream: A natural, flowing body of surface water, such as a river or creek, of any size, seasonal, temporary or permanent. Sometimes used as a synonym for creek or brook.

Stocking Rate: The number of animals that can graze an area of pasture while maintaining the health of soil, plants, wildlife and livestock.

Sub-basin:[2] A part of a river basin drained by a tributary or having characteristics that are significantly different from other areas in the basin.

Glossary Glossary of Terms as Used in the State of the Landscape Report

Surface Water:[2] Refers to water bodies such as lakes, ponds, wetlands, and streams. It may also refer to sub-surface water with a direct and immediate hydrological connection to surface water (for example, water in a well beside a river).

Sustainability:[8] The process of managing biological resources (e.g., timber, fish) to ensure replacement by regrowth or reproduction before another harvest occurs; a balance between economic growth and environmental and natural resource protection.

Sustainable Development:[4] Defined by the Brundtland Commission as "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs."

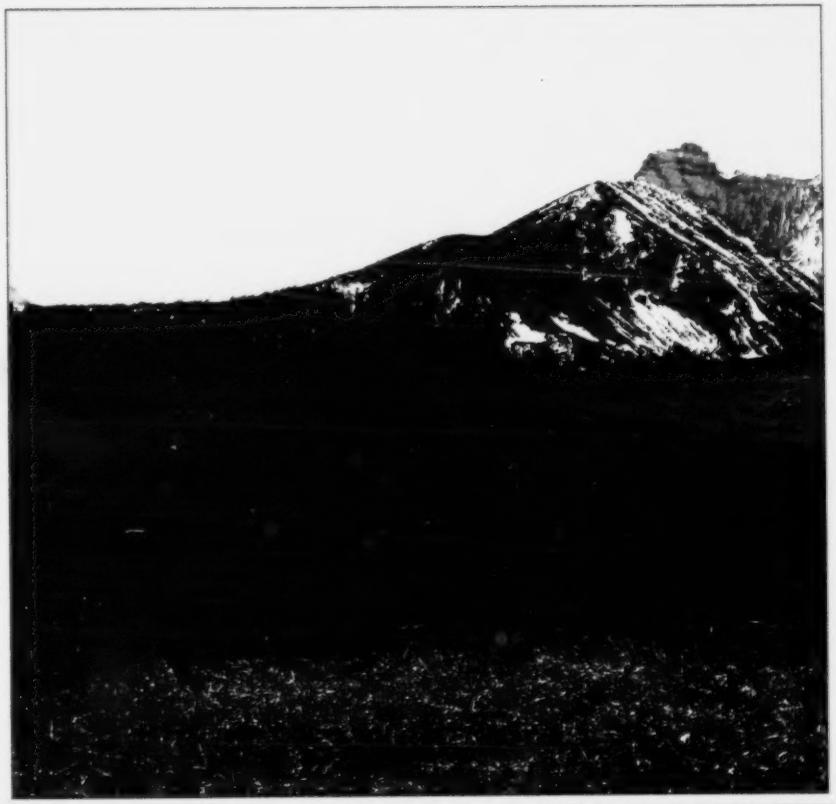
T, U, V

W

Water Quality:[1] The chemical, biological and physical characteristics of water, usually with respect to its suitability for a particular purpose.

Water Quality Guideline: A numerical concentration or narrative statement for a substance or characteristic recommended to support or maintain a designated water use. It is assumed that if the guideline is exceeded, there could be risk to aquatic life or other uses.

Watershed:[8] All lands enclosed by a continuous hydrologic-surface drainage divide and lying upslope from a specified point on a stream.



Sources of glossary definitions include:

[1] from the Northern Rivers Ecosystem Initiative – Synthesis Report glossary
[2] from Background information for public consultation on the SSRB draft water management plan
[3] from The Economic Impact of the Alberta Forest Industry, Alberta Forest Products Assn., 2005
[4] from ImagineCalgary, The City of Calgary Environmental Management, Sustainable Calgary and the Canada West Foundation http://www.imaginecalgary.ca/public/reading_room/glossary/index.php
[5] from Statistics Canada, http://www12.statcan.ca/english/census01/Products/Reference/dict/geo008.htm
[6] from Alberta Natural Heritage Information Centre
[7] from Government of Canada, www.pnr-rpn.ec.gc.ca/nature/endspecies/sar/db08s01.en.html
[8] from Sustainable Resource and Environmental Management